THE PUPIL AND ITS REFLEXES

IN INSANITY.

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by

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CONTENTS.

In the year 1850 Baillarger published an account of a new symptom which he had frequently observed in general paralysis, namely, inequality of the pupils.

Seifert, in 1853, writing on "Disturbances of the Mobility of the Iris in the Insane", pointed out that in the majority of instances cases of acute mania with miosis sooner or later developed definite signs of general paralysis.

In 1869, Argyll Robertson published his discovery that in spinal miosis the pupil contracts with convergence, but fails to contract on exposure of the eye to light. This marks an epoch in the history of the investigation of pupillary symptoms.

Since then, numerous observers have contributed to make the literature of the subject of vast extent. The condition of the pupil in organic nervous diseases has been closely investigated, and a good deal of attention has been given to the changes which it may undergo in so-called functional disorders of the nervous system and in mental diseases.

In the present instance, the pupillary anomalies which occur in insanity are discussed from the clinical standpoint. A description of the pupil and its reactions in health is given in the first place; next there/

there follows a general account of the pathological variations that may be met with. Lastly, the incidence of pupillary symptoms in certain types of mental disorder is considered, with reference both to published records and to the writer's own observations.

I./

I. THE PUPIL IN HEALTH.

The pupils are circular in outline, and of the same diameter in both eyes. When a change in size takes place, the pupil remains circular, concentric with its former phase. As a rule, the position of the pupil is not quite central with respect to the cornea, but slightly displaced inwards.

The pupils retain their equality under all conditions of illumination, accommodation, and convergence.

Slight variations from the circular form are of frequent occurrence, especially in association with small pupils, and such variations are to be regarded as physiological. Occasionally in otherwise normal eyes the position of the pupil is found to differ slightly from that above described.

Schirmer (quot. Bach, 2, p.36) examined the effect of different strengths of illumination on the pupils of a number of healthy young adults, allowing sufficient time for complete adaptation; he found that the diameter in each case remained practically constant for degrees of illumination ranging between 100 and 1100 metre-candles. This "physiological diameter" measured from $2\frac{3}{4}$ to $4\frac{3}{4}$ mm.

Age has a certain influence on the size of the pupils. The maximum diameter is reached before the age of 20; the size does not undergo much change between/

between 20 and 50, but thereafter it diminishes.

In hypermetropic eyes, the pupil on the average is smaller than in emmetropic eyes; in myopic eyes it is larger. In sleep, the pupils are small; on awakening, they dilate widely, and do not assume their usual size until some time after consciousness is fully established. Light falling on the eyes does not prevent the preliminary dilatation.

PHYSIOLOGICAL REFLEXES.

1. The Light Reflex.

If the intensity of the light which falls on the retina is suddenly increased, there is produced, after a latent period of about half a second, a marked contraction of the pupil; this is usually followed by slight dilatation and again by contraction, and so on, until after a series of rapidly diminishing oscillations the pupil finally assumes a state of contraction. If the increased illumination persists, the contraction is well maintained for some time. It will tend to disappear as the eye adapts itself to the new intensity of lighting.

2. The Consensual Light Reflex.

If one eye alone be illuminated, the pupil of the other eye contracts equally with its fellow, though the diminution in size is not so marked as in the case where/

where both eyes are illuminated. Hence, when light is falling on both eyes, the shading of one eye is followed by a dilatation of both pupils.

Many authorities maintain that unequal lighting of the eyes causes a slight difference in the size of the pupils, the more brightly illuminated eye having the smaller pupil.

3. Reflex Dilatation of the Pupil from Sensory and Psychical Stimuli.

Painful stimulation of any sensory nerve causes both pupils to dilate; a deep needle-prick in the skin may cause an increase in size of more than 3 mm. (Bumke,[8]).

Further, every sense-impression that reaches the brain from the periphery, every sudden stimulation of the tactile, muscular, or special senses, produces a widening of the pupils. Actual sensation is not necessary for the production of this reflex; stimulation of an anaesthetic area of skin is followed by reflex pupil-dilatation if the anaesthesia is due to a central lesion, or to hysteria, but the reaction cannot be produced if the anaesthesia is due to a peripheral lesion.

A similar reaction is caused by psychical stimuli, for instance by excitement, anger, fear, or any strong emotion/

emotion, by every volitional impulse, and every effort of attention. The impulse to dilatation resulting from such sensory or psychical stimuli is stronger than the strongest contraction-stimulus from light (Bach, 2, p.73).

4. Pupillary Unrest.

Much attention has been given to this phenomenon by German observers. Bach describes it as follows:-

"The size of the pupil in man in the waking state normally undergoes almost continual variations. These constant oscillations, which differ in character, in time, in amplitude, and in rapidity, show no synchronism with the action of the heart or the respiratory movements, and are independent of the variations of blood pressure. Their action is apparently quite irregular- now one sees two or three oscillations in quick sequence, then a pause of one or two seconds, and again there follows a long series of oscillations at fairly regular intervals. These oscillations of the pupil, for which Laqueur introduced the apt title of 'Pupillenunruhe' (pupillary unrest), can be observed by the naked eye both in daylight, and especially in the dark-room with oblique illumination. They are most clearly perceptible in medium-sized pupils. For more accurate study and especially for the observation of pathological conditions, examination with the Zehender/

Zehender-Westien loupe or with the Zeiss corneal microscope is recommended."

The amplitude of the movements of pupillary unrest, when powerful sensory and psychical stimuli are as far as possible avoided, is not more than about $\frac{1}{4}$ mm. on the average. They are equal and simultaneous in both eyes and occur from 30 to 120 times per minute. There is a difference of opinion as to the causation of these movements, but in the words of Ballantyne[3] there is every reason to believe that all the various stimuli which influence the normal pupil play a part in the production of the physiological oscillations, and that they are the resultant of the many influences, exciting and inhibitory (if there be such), passing to the iris via the third nerve and the sympathetic.

It is important to draw a distinction between physiological pupillary unrest and the pathological condition known as "hippus" - in which the oscillations are very large and easily seen, amounting to 2 or 3 mm.

5. Reaction of the Pupils in Near Vision.

If one is gazing into the distance, and the eyes are then directed to a near object, the pupils contract. In general the near object must be not more than 40 cm. from the face in order that an appreciable contraction may take place, and the contraction is more marked if the/

the object be nearer. As a rule the maximum degree of contraction is elicited when the fixation-object is within about 10 c.m. from the eyes. The amplitude of the contraction varies between $\frac{1}{4}$ and $\frac{3}{4}$ mm. in different persons, seldom exceeding the latter amount (Bach,2). The contraction takes place equally in both eyes, and independently of the degree of illumination.

6. The Lid-Closure or Orbicularis Reflex.

Forcible contraction of the orbicularis palpebrarum is accompanied by narrowing of the pupils. The observer should ask the patient to close the eyes firmly, while he himself holds apart the lids of one eye. It is important to bear this reaction in mind when one is attempting to examine the pupil-reactions of a refractory patient.

7. The Galvanic Pupil-Reflex.

A galvanic battery is arranged so as to send a weak current through the body, one pole being applied over the eye or on the temple close to the eye. With a suitable strength of current, closing or opening the circuit produces the sensation of light and contraction of both pupils. Closure of the circuit, the ocular pole being the anode, gives these effects with the smallest current. It is found that the minimum strength of current necessary to produce the light-sensation is

less/

less than that necessary to produce pupil-contraction, and that a fairly constant ratio exists between these values. In healthy subjects, the proportion ranges between 1 : 1.5 and 1 : 4.0 (Bumke, 8).

8. The Trigeminus-Facial Reflex.

This reaction may be elicited by firm pressure on the skin at the external canthus, or by pricking the skin of the cheek with a needle for about half a minute. Both pupils dilate, and then quickly resume their former state; if the stimulation be continued, a gradual dilatation again takes place, which persists for about two minutes, and is followed by a slow contraction. When the stimulus ceases, the pupils resume their original size. The same reaction may follow tactile, thermic, or electrical stimulation of the eyelid, conjunctiva, or cornea; but interference with the conjunctiva or cornea is much more likely to cause reflex closure of the eyelids, with miosis.

There is apparently an interplay of two impulses - one tending to dilatation of the pupils, and the other to reflex closure of the lids and miosis. (Bach, 2).

II. ANOMALIES OF THE PUPIL AND ITS REACTIONS.

1. Irregularity and Eccentricity of the Pupil.

The pupils of healthy persons have a circular outline in the great majority of cases; but slight variations from the round form are of frequent occurrence, and are to be regarded as physiological.

The pupil is usually not quite concentric with the cornea, but slightly displaced inwards. Slight variations from this location are sometimes found in otherwise normal eyes.

Congenital eccentricity of the pupil of marked degree is occasionally met with; such a condition is usually known as ectopia pupillae, or corectopia. It is convenient to employ the term "corectopia" in a wider sense, signifying any variation from the normal position of the pupil, whether marked or slight, whether of congenital origin or acquired in the course of disease.

Variations in the form or situation of the pupil may occur in diseases of the nervous system (including the psychoses); such variations may be slight or marked; they may occur merely as transient symptoms, or as more or less permanent conditions.

Irregularity of the pupil-margin may assume different forms; for instance, the pupil may be crenated/

crenated, partly circular and partly angular, partly circular and partly rectilinear, polygonal, elliptic, oval, or pear-shaped.

It is important to remember that distortion of the pupil may be of congenital origin; it may be caused by past or present local disease of the eye, such as iritis or glaucoma; or it may be a result of injury or surgical operation. Incomplete absorption of a mydriatic may occasionally cause a temporary deformity. In order to exclude irregularities due to synechiae, the eye should be examined under oblique illumination, and (in suitable cases) with the aid of a mydriatic.

The following extracts are taken from quotations in an article by J. Piltz (22) on the diagnostic value of irregularities of the pupil.

(a) Zieminski collected 207 cases of mental disturbance in which the pupils were irregular. These consisted of 198 general paralytics (including 15 cases of so-called alcoholic paralysis, and two of paralysis originating from lead-poisoning); 1 case of epilepsy, 5 of neurasthenia, and 3 of hysteria. He also observed that irregularity of the pupil may be an early symptom of general paralysis, present sometimes even in the premonitory stage.

(b)/

(b) Marandon de Montyel concludes that irregularity of the pupil-margin is practically a never-failing phenomenon in general paralysis, and that moreover it may occur in all other types of insanity.

(c) Joffroy and Schrameck believe that irregularity in the contour of the pupils indicates paralysis progressiva, tabes dorsalis, or lues; further, that this is as important as the Argyll Robertson symptom, and indeed forms its initial stage.

(d) In association with irregularity of the pupil, Salgo drew attention to unsymmetrical movement of the iris, that is, alteration in the contour of the pupil when its size changes. Different divisions of the iris show retardation or sluggishness of action in different phases of the movement, for instance in the light-reflex contraction. He found this symptom chiefly in general paralysis; though it is not pathognomonic of the disease, he regards it as a very important sign, because in early cases it may be the sole physical evidence of commencing degeneration of the brain.

Piltz notes that different portions of the iris may show sluggishness of movement on different occasions of observation. He saw this change very often in progressive paralysis, and also in Katatonia.

Piltz himself arrived at the following conclusions:-

1. There may exist the following pathological alterations of the pupil margin:-

a./

a. Temporary or changing irregularities which are caused by a varying unsymmetrical movement of single portions of the iris.

b. Disturbances of the position of the pupil.

c. Constant irregularities of the pupil margin.

2. All these changes are very frequently observed in paralysis progressiva, tabes dorsalis, and lues cerebro-spinalis.

3. Sometimes these derangements occur in the course of other nervous and mental diseases, but they are only exceptionally observed in healthy people.

4. Transitory or changing unsymmetrical movement of portions of the iris is occasionally to be seen in katatonia.

5. As irregularities of the pupil-margin sometimes precede the development of the Argyll Robertson symptom, they have considerable diagnostic importance, (Piltz, 22).

Moeli sometimes found in chronic alcoholic patients that only certain portions of the iris retained their mobility, (Bumke, 8).

Albrand (1) has recorded eccentricity and irregularity of the pupil in cases of dementia praecox. His observations will be given later.

2. Mydriasis, Miosis, Anisocoria.

Under physiological conditions the size of the pupils/

pupils may vary within wide limits in different persons; in each individual during the waking state the size of the pupil is subject, as we have seen, to constant variations. Hence it is sometimes difficult to decide, in a given case, whether the pupil-diameter is to be regarded as physiological or pathological.

Increase in the size of the pupil may be due to irritation of the pupil-dilating mechanism (spastic mydriasis), or to paralysis of the pupil-contracting mechanism (paralytic mydriasis).

Similarly, decrease in the size of the pupil may be due to irritation of the pupil-contracting mechanism (spastic miosis), or to paralysis of the pupil-dilating mechanism (paralytic miosis).

A discussion of the various lesions which may produce change in the size of one or of both pupils will not be entered upon. In the examination of insane patients the observer must bear in mind the possible existence of disturbing factors . He must exclude such conditions as aneurism of the aortic arch, tumour growth in the neck, diseases of the lung and pleura, cerebral tumour, haemorrhage, and softening, meningitis and syringomyelia. Fallacy may arise from the local application of mydriatics or miotics, or from the administration in other ways of substances which produce change in the size of the pupils.

Spastic miosis may be set up in one eye by local/

local disease or irritation, for example, iritis or a foreign body on the cornea. Miosis may also occur as an accompaniment of prolonged accommodative effort and spasm of the accommodation.

Mydriasis or miosis may be present in both eyes, or in one eye only; or the symptom may be more marked in one eye than in the other. The following remarks have special reference to bilateral conditions.

Spastic mydriasis is found in cases of psychical excitement, and in the acute psychoses generally.

Paralytic mydriasis occurs during epileptic seizures, and sometimes in tabes, general paralysis, and cerebro-spinal syphilis. Mydriasis often accompanies exhaustion, fatigue and anaemia; it may be found in hysteria and neurasthenia, and sometimes in migraine (on the affected side).

Paralytic miosis is met with in tabes and general paralysis.

Very small pupils are occasionally seen in senility and senile dementia.

Bumke (8) found that the pupil-diameter in patients at the Freiburg Psychiatric Clinic was on the average larger than the physiological diameter ($2\frac{3}{4}$ to $4\frac{3}{4}$ mm.), and varied between $3\frac{1}{2}$ and 6 mm.

Bumke also observed that insane patients who had been refusing food before admission to the asylum showed/

showed maximal mydriasis and somewhat sluggish light-reflexes; whereas after artificial feeding had been used for some days they showed normal innervation of the iris. He also carried out observations on a number of asylum night-attendants, and found that their pupils were wider in the morning following a night spent on duty than they were at the same hour on other days, and in the evening before going on duty. At the same time the reaction to sensory stimuli was usually much more active and the movements of pupillary unrest had a greater amplitude.

Inequality of the pupils - anisocoria - is easily detected, a difference in diameter of $\frac{1}{4}$ mm. being readily appreciated. Anisocoria without impairment of the pupillary reactions is not necessarily a serious symptom, for it may occur in healthy persons. Here the difference is usually not more than $\frac{1}{2}$ mm., and rarely as much as 1 mm.; the inequality persists in all states of illumination and convergence. Inequality of the pupils, associated with change in the pupil-reactions, may be taken as evidence of an organic lesion. (Ballantyne, 3).

Anisocoria was found by Bierhoff in 188 out of 7300 patients at the Marburg Eye-Clinic, that is, in about 2.6 per cent. (Cases of glaucoma, trauma, and local inflammation were excluded). A congenital origin/

origin was assigned in 60 cases. (Bach, 2).

Inequality of the pupils may be an expression of difference in the kind or degree of refractive error in the two eyes. Bierhoff found anisometropia to be the cause in six of his 188 cases of anisocoria.

Inequality of the pupils occurs in many organic nervous diseases, and also in functional disorders; the condition may be transient, constant, or subject to change. The degree of anisocoria may vary from day to day or even from hour to hour. The size-relation of the pupils may alternate; at one time the right pupil may be the larger, at another time the left. This phenomenon has been named "see-saw" or "dancing" pupils. Three groups of cases are included under the term see-saw pupils:-

1. Cases in which the size-relation of the pupils is reversed at longer or shorter intervals, it may be from day to day, or from hour to hour; usually the intervals are irregular; most frequently each pupil becomes dilated in turn (springende Mydriasis). This symptom was first noticed in tabes and general paralysis, but it has recently been discovered to exist in apparently healthy subjects, and in cases of hysteria, neurasthenia, senile dementia, arterio-sclerosis, neuralgia, epilepsy, and other diseases.

2. Cases in which one pupil undergoes change of size/

size according to illumination, etc., becoming at one time larger, at another time smaller than its fellow, which remains fixed. The symptom here depends on unilateral paralysis of the sphincter pupillae.

3. Cases in which one pupil is normal, but the other undergoes notable changes of size, independently of illumination and convergence, so that it is now larger, now smaller than its neighbour. This condition is allied to hippus. (Bach, 2).

3. Hippus.

Even in healthy persons changes of the pupil-diameter amounting to as much as 2 mm. may occur as part of the normal pupillary unrest; in hysterical and neurasthenic subjects and nervous children such variations are by no means rare (Bach, 2).

True Hippus consists in rhythmic movements of the iris, with an average period of from 1 to 3 seconds; they have an average amplitude of 2 or 3 mm., and are independent of illumination, convergence, and sensory and psychical stimuli.

Hippus is sometimes observed as an independent symptom in tabes and general paralysis, as a forerunner of the Argyll Robertson pupil. It has also been seen in certain stages of the epileptic seizure, and in post-epileptic confusion; it may occur in the seizures of general paralysis.

4./

4. Amaurotic Rigidity of the Pupil.

When a lesion causes unilateral loss of function of the retina or optic nerve, for instance on the right side, neither pupil reacts to illumination of the right eye, but illumination of the left eye elicits contraction of both pupils. The other pupillary reflexes are not disturbed. Mydriatics and miotics have their customary effect on the pupil.

If the lesion causes bilateral loss of function, neither pupil reacts to light directly or consensually.

If the function of the retina or optic nerve is only partially affected, there is diminution instead of loss of the light reflex.

In rare cases there may be loss of the light-reflex though vision is preserved, or there may be amaurosis without loss of the light reflex.

5. Hemiopic Pupil Rigidity.

This has been said to occur in association with homonymous hemianopsia, as the result of a lesion of one optic tract. Published observations of its occurrence have lately been subjected to much criticism.

6. Absolute Rigidity of the Pupil.

The term "absolute" rigidity is used in contrast to "reflex" rigidity and not in opposition to "partial" rigidity/

rigidity.

In absolute pupil-rigidity the direct and consensual light-reflexes are absent in the affected eye, as well as the near-vision reaction and the sensory and psychical reflexes. The pupil is usually moderately dilated. The symptom may be present in one eye, or, more commonly, in both eyes. If the symptom is not completely developed, there is merely a reduction in the activity of the iris; usually the near-vision reaction is less affected than the light-reflex, and it may persist for some time after the disappearance of the latter. Such a condition may be mistaken for reflex-rigidity.

Absolute rigidity is frequently a result of acquired syphilis, more rarely of inherited syphilis, and it may occur in parasyphilitic conditions. In the latter case Bach (2) is inclined to regard the symptom as a direct result of the antecedent syphilis.

Various infections and toxic conditions may produce absolute pupil-rigidity, for instance influenza and diphtheria, lead, alcohol, and ptomaine poisoning.

This phenomenon has also been observed in senile dementia, epilepsy, hysteria, and acute excitement.

It must not be forgotten that this symptom may be due to glaucoma, injury, or the use of a mydriatic, and that confusion may thus arise.

The/

The myotonic reaction is sometimes seen in cases of incomplete absolute rigidity. This consists in a very slow recovery of the pupillary contraction brought about by light, near-vision, or the orbicularis reflex, after the contracting stimulus is removed.

Bach (2) states that he never found this condition apart from incomplete absolute rigidity of the pupil.

When absolute pupil-rigidity is associated with paralysis of accommodation, the condition is known as Ophthalmoplegia Interna. It may be bilateral, like or unlike in degree in the two eyes, or more frequently unilateral. The pupils are dilated. Often the ciliary muscle is affected to a less degree than the iris.

7. Reflex Rigidity of the Pupil.

This symptom was described by Argyll Robertson in 1869, and is universally known by his name. He observed that in spinal miosis the pupils fail to react to light, but become smaller in near vision. As a rule, reflex rigidity develops gradually; the direct and consensual light-reflexes and the reaction to sensory stimuli become more and more sluggish, and miosis may appear; the near-vision reaction, however, remains normal, or in many cases becomes abnormally active.

The symptom may be unilateral or bilateral, or present/

present in different stages of development in the two eyes.

Cases are occasionally seen in which the direct and consensual light-reflexes are absent, but the sensory reaction is retained, and there is no miosis.

Anisocoria is frequently present. The size of the pupils may show change from day to day, or may undergo more gradual variation. Irregularity of the pupil margin is very common; it usually persists after the use of mydriatics and miotics.

Irregularity is often present before the development of the Argyll Robertson symptom, and it is even regarded by some as having a similar diagnostic significance.

The lid-closure reflex is often easily elicited. Several instances are recorded of return of the light-reflex, for example during remissions in general paralysis. Bach questions the accuracy of these observations.

Typical reflex-rigidity is always a sign of organic disease of the nervous system. Most authorities agree in stating that the Argyll Robertson pupil is found almost exclusively in tabes dorsalis, general paralysis and congenital and acquired syphilis, only exceptionally in other diseases of the nervous system. Such possible/

possible exceptions are certain focal cerebral lesions, especially of the corpora quadrigemina (Mott, 19), syringomyelia and rare cases of multiple neuritis, (Cestan and Dupuy-Dutemps,10). Unilateral Argyll Robertson pupil has been known to follow a punctured wound in the orbit. (Laqueur, 15: Hirschberg, 30).

When reflex pupil-rigidity is found in patients without other signs of tabes or general paralysis, and with a history of past syphilitic infection, an important question arises. If the presence of the Argyll Robertson symptom merely indicates a previous syphilitic infection, its diagnostic value is relatively slight; but if it points to the existence of the degenerative changes underlying tabes or general paralysis, it is a symptom of grave omen. Clarke (11) favours the latter view; he quotes 37 cases of gross syphilitic disease of the nervous system, in not one of which the symptom was present in its complete form. Bumke (8) quotes Thomsen as authority for the statement that the Argyll Robertson phenomenon may be present for as long as eleven years before the development of other signs of tabes or general paralysis; but he believes that it is not permissible to assume that the presence of reflex-rigidity in syphilis always indicates a meta-syphilitic degeneration of the nervous system.

Siemerling, quoted by Bach (2), examined 923 female/

female insane patients, and found reflex rigidity in 79, incomplete reflex-rigidity in 14 more. His results are given in the following table, which shows in how many cases and in what conditions the symptom was observed.

Disease.	Light Reaction Absent.	Minimal Light Reaction.
General Paralysis	63	12
Epilepsy	2	1
Hysteria	1	-
Paranoia	-	1
Senile Dementia	2	-
Alcoholism	2	-
Syphilis	2	-
Tabes with Psychosis	5	-
Hemiplegia	1	-
Cerebro-spinal Meningitis	1	-
	79	14

It appears that in nearly 90 per cent of the cases, the symptom was associated with general paralysis, tabes, or syphilis.

Siemerling also examined 9160 patients at the Charité, of whome 1639 had reflex rigidity. 1570 of these, or over 95 per cent, suffered from general paralysis/

paralysis, tabes with mental symptoms, or cerebro spinal syphilis. His figures are given in the following table.

General Paralysis	1524 cases.
Tabes with Psychosis	29
Senile Dementia	19
Syphilis of the Central Nervous System	17
Focal lesions	19
Alcoholism	15
Injury of the head	1
Epilepsy	4
Hysteria	4
Paranoia	7
	1639

Bach makes the apt criticism that many of the non-tabetic and non-paralytic cases enumerated above might eventually prove to be suffering either from general paralysis or from tabes.

Moeli, quoted by Bumke (8), observed reflex pupil-rigidity in 56 patients whose condition could not be diagnosed at the time as general paralysis or tabes. Of these, after a period of from 3 to 6 years had elapsed, 14 were recognised as tabetic, and 7 as paralytic; 10 had cerebral disease other than general paralysis, and were either syphilitic or alcoholic patients. The remaining 25 were probably not syphilitic/

syphilitic.

Moeli estimated that 98.6 per cent of all his cases of reflex-rigidity were either paralytics or tabetics.

Amaurotic rigidity, absolute rigidity, and the Argyll Robertson symptom may be mistaken for one another. Ballantyne (3) lays stress on the following points of distinction. Both in reflex and in amaurotic rigidity we find absence of the light reflex with preservation of the near-vision reaction; in the latter case however, there is blindness, usually with mydriasis; in the former case blindness is a rare complication, and there is usually miosis, and often an undue activity of the near-vision reflex. Typical cases of reflex rigidity and absolute rigidity are easily distinguished by the absence of the near-vision reflex in the latter. It may be difficult or impossible to distinguish the Argyll Robertson pupil from the incomplete form of absolute rigidity in which a convergence reaction is obtainable. The distinction must depend chiefly on the presence or absence of miosis and on the state of the near vision reflex. In incomplete absolute rigidity the near-vision reflex, if present, is deficient, or may show the myotonic character, whereas in the Argyll Robertson pupil the convergence contraction is active, and may be unusually well-marked.

Bach/

Bach maintains that the true Argyll Robertson symptom never develops into absolute pupil-rigidity. If this statement be correct, it is of value from the diagnostic point of view, for reflex rigidity has a very close association with tabes and general paralysis, while the absolutely rigid pupil occurs in a wide variety of diseases.

The Neurotonic Reaction consists in a slow contraction of the pupil, produced only after illumination has been continued for some time. The contraction usually remains for some seconds, occasionally rather longer, and then slowly passes off. This symptom may be seen in certain cases where amaurotic rigidity is being developed, more rarely in incomplete reflex-rigidity (Bach, 2).

8. Paradoxical Light Reaction.

This consists in dilatation of the pupil when the eye is illuminated, and contraction when it is shaded; it may be elicited either directly or consensually. Usually the near-vision reaction is normal.

This condition is very rare. It may be simulated by other phenomena.

Bach remarks that in cases of marked paresis of the sphincter pupillae, illumination of the eye produces a very slight contraction of the pupil, followed/

followed by a fairly quick and occasionally marked dilatation, which is due to atony of the sphincter. It would not be permissible to describe this phenomenon as an instance of paradoxical reaction.

9. Failure of the Near-Vision Reaction.

Occasionally it is found that the light-reflex is preserved, but the pupil fails to contract in near vision. This phenomenon has been recorded by Lauder Brunton (7) in a number of cases of alcoholic neuritis. It is not uncommon in post-diphtheritic neuritis (Purves Stewart, 23); and it has been exceptionally observed in general paralysis (Wernicke, quot. Laqueur, 15).

10. Perverse Near Vision Reaction.

This condition is excessively rare; it consists in dilatation of the pupil in looking at a near object and contraction in gazing into the distance.

11. Loss of the Reaction to Sensory Stimuli usually accompanies absolute and reflex rigidity of the pupil. It may be caused by a lesion which breaks the path of the sympathetic supply to the iris. It has been observed in katatonia and other mental diseases, apparently as a functional symptom, often without impairment of the reactions to light and near vision. On the whole this condition is most frequently found in/

in association with the Argyll Robertson pupil.

12. Absence of Pupillary Unrest usually occurs in the same conditions as absence of the sensory reflex. Bumke has drawn attention to its occurrence in dementia praecox.

He has also observed that in many patients pupillary unrest and the reaction to psychical stimuli may be absent, at a time when the reflex dilatation of the pupil from painful stimuli can still be obtained.

13. Undue activity of the sensory reflex and exaggeration of the pupillary unrest have been observed in some of the neuroses, such as hysteria, in certain stages of alcoholic intoxication, and in states of fatigue, (Bumke, 8).

14. The trigeminus-facial reflex is said to be present in all healthy persons; but in insane patients, especially in general paralytics, it is often altered or altogether absent. (Stefani and Bordera, quot. Bach, 2.)

III. PUPILLARY SYMPTOMS IN CERTAIN TYPES OF MENTAL DISEASE.

1. General Paralysis.

Progressive general paralysis is remarkable for the frequency, multiplicity, and variety of its pupillary symptoms, which may often be evident even in the incipient stage of the disease.

From the diagnostic point of view, the most frequent and the most important of these is the Argyll Robertson phenomenon. The presence of this classic symptom in a patient suffering from mental disorder of a somewhat indefinite nature gives rise to the strongest suspicion that the case in question is one of general paralysis. But reflex rigidity also occurs in tabes and syphilis; and intercurrent psychoses in the course of these diseases are not uncommon. Berkley (4) however states that mental disorder accompanied by signs of tabes almost always develops into progressive paralysis.

Reflex rigidity in general paralysis may be unilateral, or, more often, bilateral. The pupils are often medium in size, or even dilated. In cases of paralysis with tabetic symptoms they are usually small. Typical reflex rigidity is specially frequent in tabetic paralysis; according to Moeli, it is/

is found in 84 per cent of the cases (Bumke, 8).

Cases which present, not abolition of the light reflex but impairment of its activity, while the near-vision reaction is either unaffected or unduly active, are with propriety classed along with those which show the fully developed Argyll Robertson symptom.

The next most important pupillary symptom is absolute rigidity. It may be associated with mydriasis, or, less frequently, with miosis. Absolute rigidity, however, is by no means such a strong indication of general paralysis as the Argyll Robertson symptom, for the former is relatively frequent in conditions such as syphilis, chronic alcohol poisoning, and senile dementia.

The occurrence of ophthalmoplegia interna in general paralysis has been recorded; Bumke thinks that its presence rather indicates syphilitic pseudo-paralysis. Nevertheless, trustworthy observers have described the occurrence of ophthalmoplegia interna in otherwise typical cases of general paralysis, and it must be accepted as a possible symptom (Bevan Lewis, 17).

Bumke (8) has collected statistics on the condition of the light-reflex in general paralysis. From published records of over 3000 cases, he finds that the/

the light-reflex was absent in 45.4 per cent, impaired in 28.3 per cent, and unimpaired in 26.3 per cent.

Bach (2) estimates that bilateral loss of the light-reflex is more frequent than unilateral in the proportion of 4 to 1. Inactivity of the pupil of one side only is seldom persistent, since the other as a rule soon becomes affected (Berkley, 4).

The near vision reaction is active in 77 per cent of general paralytics, impaired in 11 per cent, and absent in 12 per cent (deduced from records of 578 cases given by Bach, 2).

The sensory reflex usually becomes more and more sluggish as light-rigidity develops; when the latter is complete, the sensory reflex is only exceptionally present (Bach). On the other hand, this reaction may be absent while the light-reflex is retained; Hirschl maintains that the sensory reflex usually disappears before the light-reflex (Bumke, 8). Bevan Lewis (16) is of the same opinion.

Pupillary unrest is absent in a large proportion of paralytics in association with reflex or absolute rigidity; it may however be absent when the action of the iris is apparently normal in other respects, (Bach, 2).

The myotonic reaction is occasionally seen in retrogressing or not completely developed absolute rigidity/

rigidity. In rare cases of incomplete reflex rigidity the neurotonic reaction may be observed.

Exceptionally the light-reflex is found to be present, and the near-vision reaction absent. Bevan Lewis (17) mentions one case of a female paralytic who showed paralysis of accommodation and loss of the near-vision reaction, with only partial impairment of the light-reflex. Wernicke (quot.. Laqueur, 15) records a similar case.

The paradoxical reaction is recorded in some cases.

Bevan Lewis (17) describes the occurrence in certain cases of general paralysis of an interesting phenomenon to which allusion has already been made. In testing the light-reflex by concentrated light through a bull's-eye condenser, he found that the initial contraction thus induced may be succeeded by a secondary dilatation - the pupil expanding widely in spite of the concentrated illumination. He saw this symptom in 13.6 per cent of his cases, and refers it to commencing paralysis of the centre of the third cranial nerve.

Hirschl (quot. Bumke, 8) remarks that such a phenomenon may be an instance of pupillary dilatation caused by a strong sensory stimulus.

Irregularity of the pupils is present in a very large proportion of general paralytics. Corectopia may/

may also be found.

The occurrence of unsymmetrical movement of the iris in response to stimuli has already been mentioned. Inequality of the pupils is extremely common. The statistics of various writers on this point show marked differences; the proportion of cases in which anisocoria is present varies from 92 per cent to 26 per cent and even lower. Evidently a large allowance has to be made for the personal equation of the observer.

Inequality may occur whether the light-reflex is present, absent, or merely sluggish. Bevan Lewis (17) found that out of 73 paralytics showing loss of direct and consensual light-reflex in both eyes, 34 had unequal pupils; out of 71 other paralytics in whom the light-reflex was intact or only sluggish, 33 showed a notable inequality of the pupils.

Changes in the relative size of the pupils, their outline, and their position with respect to the centre of the cornea, are quite common. Such variations may take place gradually from day to day, or comparatively suddenly, without any apparent relation to the other symptoms of the patient; or they may be observed to accompany epileptiform or apoplectiform seizures.

See-saw pupils are occasionally found in general paralytics, either associated with unilateral hippus, or depending on unilateral loss of the light-reflex,

or/

or in the form of alternating mydriasis.

Hippus is sometimes observed in general paralysis, especially in association with seizures.

The Incidence of Pupillary Symptoms in the Different Stages of General Paralysis.

Different writers lay stress on different isolated symptoms which may be the sole evidence of disturbance of the pupillary mechanism in cases of commencing general paralysis, and which may be regarded for the most part as forerunners of the more definite and typical ocular phenomena. Among these early symptoms are the following:-

1. Irregularity of the pupil.
2. Unsymmetrical movement of the iris. (Salgo, quot. Piltz. 22)
3. Inequality of the pupils.
4. Hippus.
5. See-saw pupils (alternating mydriasis).
6. Absence of pupillary unrest (Bach, 2).
7. Loss of sensory reflex.
8. Sluggishness of the light reflex.
9. Loss of the consensual light reflex.

The views of Salgo and Piltz (22) on the significance of irregularity of the pupil and irregular movement of the iris have already been mentioned. Bevan Lewis (17) records a case in which both pupils were equal and somewhat dilated and still reacted to light, but/

but in which hippus was present in the right eye.

Bevan Lewis (16) regards loss of the sensory reaction as a symptom of almost constant occurrence in early cases of general paralysis. Berkley (4) has observed in a considerable number of cases that loss of the consensual light reflex preceded loss of the direct light reflex. The presence of this symptom, when combined with mental phenomena, has led him to make a tentative diagnosis of general paresis.

The actual diagnosis of a case presenting only one of the various early pupillary symptoms must depend on the other clinical features; the observer at any rate has received warning of the possibility of further developments.

In individual patients, no particular connection can be established between the nature and degree of impairment of the pupillary reactions and the stage of the disease. Cases occur in which the ocular symptoms are marked from the first time that the patient is brought under observation. Spastic miosis has been observed to antedate the full development of the disease by ten years. (Thomsen, quot. Bach, 2.) On the other hand, there are comparatively advanced cases to be found, in which pupillary symptoms are not well marked.

An interesting series of observations has been made/

made by Marandon de Montyel (18) on the state of the light reflex in 140 cases of general paralysis, from the commencement of the disease till death. Of these, 50 died in the first stage, 36 in the second, and 54 in the third. Out of the whole number, the light reflex was always normal in 24 per cent, always abnormal in 17 per cent, and subject to change in 58 per cent.

The condition of the light reflex in the patients during the different stages is shown by the following table:-

Light Reflex	Patients in Stage 1.	Patients in Stage 2.	Patients in Stage 3.
Always normal	42%	29%	3%
Subject to change	32%	35%	11%
Always abnormal	24%	34%	85%

In the first stage, 6 per cent showed exaggeration of the light-reflex in both eyes; 10 per cent showed diminution or abolition of the reflex in one eye. Of the 54 patients who survived till the final stage, every one showed some abnormality at one time or another.

We may conclude that impairment of the light reflex is relatively much more common in the advanced stages of the disease.

In the remissions which sometimes occur in the course of general paralysis, a retrogression of the Argyll/

Argyll Robertson symptom has been observed by various authorities. For instance Tanzi (24) says that he has been able to prove that the immobility of the pupil may disappear and reappear in the course of general paralysis, as it has been observed to do in tabes dorsalis. Bumke (8) records one case of retrogression of the already almost extinguished light-reaction in a paralytic during a remission. Dana (28) records one or two cases of what he calls "preparesis", in which complete Argyll Robertson pupils regained their activity after anti-luetic and hygienic treatment.

When once the Argyll Robertson pupil is fully developed, return of the light reflex is considered by Bach and Bumke to be an extremely rare occurrence. It is possible that some of the recorded instances have been due to faulty observation or inaccurate diagnosis. For example, in pseudo-paralysis due to cerebral syphilis or certain chronic intoxications, immobile pupils have sometimes been found to recover their activity, in association with improvement of the other symptoms.

Miosis, when present, is more often found in the earlier stages of general paralysis, and mydriasis in the later stages. An initially small pupil may gradually become dilated as the disease progresses. Occasionally marked mydriasis may be present from the beginning/

beginning. Miosis is apt to occur during the irritative phase, mydriasis in the terminal stage of exhaustion.

In the seizures - epileptiform and apoplectiform - which are not uncommon, the pupils as a general rule show absolute rigidity; and variations in their size, form, and situation may take place. Frequently there is mydriasis, which may be marked, even where spastic miosis has previously been found. In other cases, there is absolute miotic rigidity. Hippus and see-saw pupils have been observed in association with seizures.

Table VI (Sheets B C D E F) gives the records of my observations on 66 cases of general paralysis.

One case, No. 67 (Sheet F), is probably only a pseudo-paralytic. The patient is of advanced age - 69 years - suffers from arteriosclerosis, and has symptoms indicative of tabes dorsalis. He shows a paradoxical light-reaction in each eye, both to day-light and to the electric light from a hand lamp. Both pupils dilate slightly, usually about $\frac{1}{4}$ mm.; they resume their original diameter when the light is removed. There is no consensual reaction. The sensory reflex and near-vision reaction are both absent. There is no unrest visible to the naked eye. Both pupils are small and irregular; the right is $\frac{1}{4}$ mm. larger/

larger than the left. There is marked internal strabismus, both eyes being amblyopic. I have not come to a definite conclusion about this case, but have included it here provisionally.

The 66 cases of general paralysis vary in age from 15 to 66. The average pupil diameter is 4.4 mm. In every case the condition of the pupils showed some departure from the normal.

Anisocoria was found in every case but five; in these only one measurement is recorded. Both pupils showed irregularity except in six cases, in which only one record of the pupil-outline is given; of the six exceptions, in three one pupil was irregular, in three both pupils were regular.

The first 24 cases show the Argyll Robertson symptom, 17 in both eyes, 7 in only one eye; that is, 36 per cent of the whole.

The average pupil diameter is 4.1 mm. Only five cases had a pupil-diameter of less than 3 mm. and 7 cases had a pupil-diameter of over 5 mm. at one time or another. Anisocoria is the rule, the difference being usually not more than $\frac{3}{4}$ mm. Five cases showed a difference of 1 mm. or over. Equal pupils are recorded at one time or another in eight cases. Change in the size-relation is shown by 14 cases, of which 3 show reversal (No. 4, 9, 21).

Temporary reappearance of the light-reflex is shown in No. 4, 19 and 24.

Loss/

Loss of consensual reaction precedes loss of the direct light reflex in No. 13 and 18.

The sensory reaction was usually absent when there was no light reflex; but exceptions are found in No. 2, 4, 8, 12, and 17.

Loss of sensory reaction preceded loss of light reaction in No. 12, 13, and 19. In one case slight unrest was present though the sensory reflex was absent - No. 18.

Alteration in the outline of the pupils is recorded in every instance where there are repeated observations; for example, the left pupil in Nos 14 and 16.

The next 15 cases (No. 25 to 39) show bilateral impairment of the light reflex with activity of the near vision reaction. These are cases of bilateral incompletely developed reflex-rigidity, and amount to nearly 23 per cent of the whole. The average pupil-diameter is 4.7 mm.

Anisocoria is very common. Equality of the pupils is recorded in 5 cases, of which 2 had only a single measurement. Change in size-relation is seen in eight cases.

In No. 30, the absolute pupil-rigidity present on admission may be ascribed to alcoholic poisoning.

In No. 33 pupil-rigidity and corectopia appeared in a seizure followed by coma, which ended fatally.

In No. 38 and 39 renewed activity of the light reflex/

reflex followed a period of sluggishness. Loss of the sensory reflex at a time when the light-reflex is not yet extinguished is shown by No. 27, 29, 30, 33, 34, 35 and 37; in the last of these the sensory reflex was lost before the light reflex began to be affected.

Change in the outline of the pupils is shown by several records.

Altogether, then, 39 cases out of 66 present the Argyll Robertson symptom, either complete or incomplete; that is, 59 per cent.

Absolute rigidity of both pupils is shown in five cases (No. 40 to 44); unilateral absolute rigidity in one case (No. 45). If No. 44, a case of juvenile general paralysis, be excluded, the average pupil diameter is 4.1 mm.

Marked inequality of the pupils was present in No. 40, 42, and 45. No. 45 also showed marked variation in the size-relation of the pupils, and in their outline. Irregularity of both pupils is the rule. The corectopia in No. 44 may be of congenital origin. No. 45 gives the picture of the Argyll Robertson symptom on the right side, and absolute rigidity on the left side. Nine per cent of the cases, then, show absolute rigidity.

No. 46 and 47 are cases of incompletely developed bilateral absolute rigidity. No. 46 has shown

gradually/

gradually increasing ptosis on the left side. No. 47 is a case with a history of lead-poisoning, in which general paralysis has developed. Both cases show changing irregularities.

Complete or incomplete absolute rigidity was therefore present in eight cases; that is in 12 per cent.

Four cases, No. 48 to 51, showed impairment of the light reflex in one eye, in No. 50 as a transient alternating symptom only. Nos. 50 and 51 show loss of the sensory reflex.

In case No. 52, the patient resisted further examination. Both consensual reflexes were absent, though the direct light reflexes were active.

13 cases, No. 53 to 65, showed no alteration of the light reflexes, beyond sluggishness of the consensual reflex in one eye in No. 58. The average pupil diameter is 5 mm.

Loss of the sensory reflex was found in five cases, but in two only as a temporary symptom. The sensory reflex was diminished in five others. In every case there was inequality of the pupils. Both pupils showed irregularity in all but No. 65, of which only one record is available. Changes in the pupil-outline were noticed in nearly every case.

Altogether/

Altogether 14 cases showed no impairment of the direct light reflex in either eye - amounting to 21 per cent of the whole.

No. 66 was a case of juvenile paralysis, in which double optic atrophy and double amaurotic rigidity were present. The loss of the sensory reflex however rather indicates the superposition of a condition of absolute or perhaps reflex rigidity.

The figures and percentages arrived at from my records are not of much value for statistical purposes. An investigation of a much larger number of cases, conducted on the lines followed by Marandon de Montyel (18), would be required in order to give any noteworthy results. My cases serve to illustrate much of what has been recorded in the literature and already summarised in these pages.

The records of pupillary unrest in the table are incomplete. They are estimated by the naked eye only. There was no Zeiss binocular microscope available, and I did not find a corneal loupe of much advantage for the examination of pupillary unrest, chiefly owing to its small field.

2. Syphilitic Insanity.

Marked pupillary symptoms are found in many cases of insanity due to cerebral syphilis, though on the whole/

whole they are not so frequent as in general paralysis. The clinical picture of this type of mental disease may closely resemble that of general paralysis, giving rise to one form of pseudo-paralysis.

Absolute rigidity of the pupils may be found in cerebral syphilis, usually in both eyes. Miosis in this condition is uncommon.

Ophthalmoplegia interna also occurs, more often on one side only, along with mydriasis. Amaurotic rigidity may be developed, from primary or secondary affections of the optic nerve or tract, or the chiasma.

The Argyll Robertson symptom is seldom found in uncomplicated cerebral syphilis.

Bumke (8) maintains that when reflex or absolute rigidity persists as an isolated symptom for a considerable time, the case in question is more probably one of general paralysis or tabes. If other symptoms develop, such as transitory or permanent ptosis, ophthalmoplegia externa, or paralysis of the abducens, cerebral syphilis is decidedly indicated.

Inequality and irregularity of the pupils are common in cerebral syphilis. See-saw pupils may occur. The paradoxical light reflex, and the neurotonic and myotonic reactions have all been observed in this condition.

Reappearance of the light-reflex after it has been lost has been described, usually following antisyphilitic treatment/

treatment.

Temporary reappearance of the light-reflex may be noticed when the patient is kept for some time in a dark room; this phenomenon is regarded as a symptom of progress towards recovery (Bach, 2).

In table V. Sheet B, seven cases of syphilitic insanity are recorded.

No. 1 was a case of congenital syphilis; the patient was 17 years old, and he died from acute nephritis. No evidence of general paralysis was found on post mortem examination. The pupils showed no abnormality except that they differed slightly in size.

No. 2 was a case of temporary excitement commencing two months after the primary lesion. Both pupils were slightly irregular, but otherwise normal. The patient - aged 19 - was discharged recovered.

No. 3, 4, and 5 may eventually prove to be general paralytics. No. 3 shows marked inequality of the pupils, and changing irregularities. No. 4 has irregular unequal pupils, and sluggishness of the direct and consensual light reflex in the right eye. No. 5 had diminished sensory reaction, which has regained its activity. There is a certain degree of corectopia in the left eye, which may be congenital.

No. 6 was a case of temporary confusional insanity in a man of 42. Except for diminished sensory reaction/

reaction the pupils were normal.

No. 7 has shown inequality of the pupils and absence of both consensual reflexes for 22 years. During that period the patient - a woman - has suffered from various syphilitic manifestations at different times. She has had a macular skin eruption, peripheral neuritis with temporary left ptosis, and repeated ulceration of the leg; all these conditions cleared up under anti-syphilitic treatment. Clinically she is not a general paralytic. The pupils are circular, the direct light reflexes are present, but the sensory reflex is absent in both eyes.

3. The Toxic Psychoses.

a. Alcoholic Insanity.

In the "physiological intoxication" of healthy persons, there may be no disturbance of the pupil-reflexes. In the stage of exaltation, the pupils are often dilated. Sometimes an increased activity of the light-reflex and the sensory and psychical reflexes has been observed. (Hübner, quot. Bach, 2).

In persons intolerant of alcohol the reflexes may show diminished activity. The pupils in advanced intoxication may be small or large. Gudden observed sluggishness and even complete loss of the reactions in severe intoxication with insensibility. (Bach, 2.) These symptoms disappeared as consciousness returned.

In/

In idiots and degenerates Vogt found that a dose of 40 c.c. of arrack or rum in water produced change in the pupil-reactions in about one-third of his cases; usually the light-reflex became sluggish.

As Stoddart (24) remarks, not every case of mental disease with a history of previous alcoholic excess is a case of alcoholic insanity. Turner (26) would limit the application of the term "alcoholic insanity" to cases in which there is alcoholic neuritis.

For our present purpose, the psychoses which directly or indirectly originate from long-continued alcoholic excesses are grouped together. Most of the patients suffer from a congenital instability of the nervous system, and a deficient power of resistance to toxic influences. We should expect such cases, if any, to present symptoms of disorder or degeneration of the nervous system after prolonged alcoholic poisoning.

In chronic alcoholics the pupils are frequently found to be of relatively small size, rarely dilated; their reactions are proportionately sluggish and of small amplitude. The degree of impairment of the reactions seems to be proportional to the severity of the toxic process (Bach). The average quickness of response to light is below the normal. In very rare cases the disturbance is unilateral.

The/

The light reflex alone may be diminished, or the reactions to near vision and sensory stimuli may be implicated as well. The myotonic reaction is sometimes observed.

In exceptional cases the Argyll Robertson symptom has been recorded. Moeli (quot. Bumke, 8) says that in very rare cases this symptom is found fully developed and lasting for some time. Whether it really depends on alcoholic excess or not is not quite certain. He allows that a transitory sluggishness may be caused in this way. He has also seen frequent temporary relaxations of the iris, disturbances of the convergence-reaction, and the retention of activity only in isolated portions of the iris. Raimann (quot. Bumke) describes 10 cases of alcoholics presenting complete loss of light reaction; in some of the cases absolute rigidity supervened, but in every instance the light reflex finally returned.

Bertozzi (5) believes that permanent alterations of the pupil are frequently found in insane patients suffering from the effects of chronic alcoholism, especially permanent spastic miosis. Bumke (8) concludes that the most frequent pupillary symptom of alcoholism is a general sluggishness of the reactions, and that absolute rigidity is comparatively rare; further, that in certain stages of development or retrogression/

retrogression of the latter symptom the light reflex may be so much more affected than the convergence reaction as to simulate the Argyll Robertson phenomenon. He also would refer some of the cases of apparent reflex-rigidity to amaurosis following optic neuritis. Diminution of the light reaction is recorded in 2.5 per cent of the cases, and inequality of the pupils in about the same proportion. On the whole, changes in the innervation of the iris are found in 6 per cent of the cases, and they are usually of a temporary nature.

In delirium tremens the pupils are at first contracted, but they usually become dilated as the disease progresses, (Stoddart, 24). A sluggish reaction of the pupil to light, and even complete Argyll Robertson pupil may be found. This sign however disappears on recovery. (White, 27.)

In mania a potu miosis and anisocoria may be observed.

In Table I (Sheet A) are collected ten cases of temporary mental disorder of alcoholic origin. The patients had all taken alcohol in excess for long periods, and they presented mental symptoms characterised by marked confusion along with varying degrees of excitement. They were all males; the age varied from 34 to 60. The average pupil-diameter was 5.1 mm. Two cases showed

equality/

equality of the pupils, two had slight inequality, and in six the pupils differed by ½ mm. or more. In only one case were both pupils circular, four showed irregularity of one pupil, and the remaining five had bilateral irregularity mostly of slight degree.

Three cases showed diminished direct and consensual reaction to light; two had impaired sensory reflexes.

On the whole, there was deviation from the normal condition of the pupil in all but one case, though the abnormalities were mostly of slight degree. In the majority of the patients there was some irregularity and inequality of the pupils.

In polyneuritic alcoholic insanity, which is the most common variety of Korsakow's psychosis, pupillary disturbances are not infrequent, and they usually vary in intensity from day to day.

Inequality of the pupils, sluggishness of the reactions to light and convergence, and even transitory Argyll Robertson pupil, may be observed.

Turner (26) records the condition of the pupils in 68 cases of this disorder. Anisocoria was present in 26.4 per cent; sometimes the inequality on different days was subject to alternation, first one pupil and then the other being the larger. In 34.2 per cent, the pupils either reacted very slightly and sluggishly to light, or were rigid; but this condition/

condition in most cases was only temporary. In eight cases the pupils appeared at one time quite rigid to light; in at least six of these the condition was undoubtedly temporary.

Lauder Brunton (7) has recorded that in a number of cases of alcoholic neuritis the reaction of the pupil to light was rapid and extensive, while the contraction on accommodation was slight and sluggish or entirely wanting; in one or two cases he observed dilatation instead of contraction with accommodation.

In table II (A) I have recorded two cases of polyneuritic alcoholic insanity. The patients were aged 28 and 39 respectively. The average pupil-diameter was 5 mm. Both cases exhibit change in the size and size-relation of the pupils, as well as in their outline. In both cases the sensory reflex was absent on admission; afterwards the reflex appeared again, but it was diminished in activity. The light-reflex in the second case was sluggish, but later it returned to the normal.

In alcoholic pseudo-paresis, pupillary inequality is not uncommon; sometimes the light-reflex is absent, with slowness of reaction to near-vision. The symptoms usually undergo improvement on removal of the poison, and they may more or less completely disappear, (White, 27; Berkley, 4).

Table/

Table III (A and B) deals with the pupillary records of 26 cases of chronic alcoholic insanity. The patients have taken alcohol to excess for many years, and have sustained irreparable damage to the cerebral cortex, which is expressed symptomatically by the dementia from which they all suffer in greater or less degree. Cases No. 2, 4, 7, and 8 presented the picture of alcoholic pseudo-paresis.

The age varies from 36 to 60 years. The average pupil diameter of all the cases is 4.4 mm.

In eight cases the pupils were equal; in nine there was slight inequality, and in nine the difference in size was more marked. No. 6, 11 and 14 show change in size-relation of the pupils.

Both pupils were circular in eight cases; slight irregularity of one pupil is present in three cases, and of both pupils in 15. In four cases change in the form of the pupils is recorded. Eight cases show diminished reaction to light in both eyes; in No. 11 the formerly sluggish light-reflexes regained their activity. In three cases the direct and consensual reflexes are sluggish in one eye. In No. 19 there is loss of the consensual reflex in one eye.

In 15 cases the light reflexes were normal. In five cases the near-vision reaction was diminished, and partial recovery is shown in No. 14.

Absence/

Absence of the sensory reflex was observed in six cases; the reflex was present but diminished in eleven; present and active in six cases (out of 23). In one case the sensory reflex was absent, but returned (No. 14); in another it was diminished and then disappeared (No. 6).

In two cases the condition of the pupils was practically normal. In seven cases diminution or loss of the sensory reaction was the only reflex-symptom. In five cases no abnormality of the reflexes is recorded; and in five cases all the reflexes were affected.

On the whole, we find rather small pupils, as a rule presenting no marked inequality, but showing in most cases some irregularity of outline. Both the anisocoria and the irregularity may be subject to variation from time to time. The light-reflex (direct and consensual) is usually present, but often sluggish. Occasionally the near vision reaction may be diminished as well. Diminution or loss of the sensory reaction may be the only disturbance affecting the pupil-reflexes.

b. Insanity from Lead Poisoning.

In this condition there may be slowly reacting and unequal pupils, associated with optic neuritis. In some cases optic atrophy supervenes, with amaurotic rigidity. The poison may also directly attack the nerves/

nerves of the interior muscles of the eye, especially the sphincter pupillae. (Bach, 2)

Clinically some of the cases resemble general paralysis (plumbic pseudo-paresis), and true general paralysis may be developed in patients who have suffered from plumbism.

Table IV (B) contains one case of insanity from plumbism. The patient's age on admission was 65. The pupils are unequal, and show irregularity which has changed in character. The light-reflex (direct and consensual) and the sensory reaction have become diminished. Unrest is not now visible to the naked eye. The near-vision remains active. The advanced age of the patient is a complicating factor.

c. Less frequent Toxic Conditions.

In chloral-hydrate poisoning, which sometimes produces insanity, there may be miosis, with loss or impairment of the reaction to sensory and psychical stimuli. These phenomena disappear as the drug is eliminated. (Bach, 2.)

Insanity from morphine. Miosis is present in the early stages, mydriasis later, with sluggish reaction of the pupils (Berkley, 4). According to Bumke (8), the light-reaction may be present, or the pupils may react sluggishly or not at all to light. The reaction to sensory stimuli is diminished or abolished, but/

but the reaction to convergence is present. Cases showing contracted fixed pupils have however been described. Uhthoff (quot. Bumke) states that the light-reflex is never quite abolished, unless morphinism is associated with some other factor (for instance, in physiological old age).

If the administration of opium or morphia be stopped, or even if the dose be markedly diminished, mydriasis may occur, along with increased activity of the pupil. (Bumke.)

Insanity from carbon-bisulphide poisoning. In this condition unequal and slowly-reacting pupils have been described, and in some cases, wide dilatation and absence of the reaction to light. (Berkley, 4.)

A pseudo-paresis uraemica has been described, in which the pupils may either be miotic and non-reactive, or widely dilated, regular, and slowly reactive to light and accommodation (Berkley).

In pseudo-paresis diabetica - a rare condition - the pupils are usually unequal, reacting to light and accommodation, though unequally (Berkley).

Bromide of potassium given repeatedly or in large doses gradually produces dilatation of the pupils and sluggishness of their reactions, including the galvanic reflex (Bach, 2; Bumke, 8).

This/

This should not be forgotten in the examination of epileptics for pupillary symptoms.

Insanity from bromide poisoning is recorded. A delirious form has been described by Casamajor (9), in which irregular, unequal, sluggishly reacting pupils may be found.

4. Insanity with Epilepsy.

The pupillary symptoms are separable into two groups, those which are associated with fits, and those which are found in the intermediate periods.

In general, during an epileptic fit the pupils are large and irresponsive to light or sensory stimuli. It is quite exceptional for the pupil to preserve its reaction to light and sensory stimuli throughout the whole course of a fit.

A marked transitory contraction of the pupils is often observed at the commencement of a fit; this is also the case in animals thrown into convulsions by the administration of creatinin.

In the tonic stage, the pupils are dilated and fixed.

In the clonic stage as a general rule they still remain dilated and fixed. Occasionally, however, hippus is observed, consisting in convulsive movements of the iris which take place at irregular intervals, it may be only once in a period of one or two seconds, or/

or in close succession; the pupil contracts to a medium size, rarely to a marked degree of miosis, and almost at once dilates again to its original size. These variations in diameter are independent of the movements of the eyeball, and the pupil remains irresponsive to light. Anisocoria, elliptic pupils, and corectopia are occasionally found. Distorted, markedly irregular pupils are never seen in genuine epileptic fits. (Bumke, 8.)

In the period of stertor which usually follows a fit, in some cases the pupils are fixed, in other cases they react. In the deep sleep which may follow a fit, fixed contracted pupils may be found (Bach,2). As a rule, in post-epileptic stupor the pupils show no marked deviation from the normal. Bumke records that in two epileptics in this stage he found the pupils markedly dilated, reacting with convergence and on strong illumination; the sensory reflex was absent, and the sensitivity of the galvanic reflex was diminished.

Wassermeyer (quot. Bach, 2) found absence of pupillary unrest as an occasional symptom in post-epileptic stupor, the light reflex at the same time being preserved. In status epilepticus and epileptic coma pupil-rigidity is the rule. Exceptionally the light-reflex may be retained in coma. (Oppenheim, quot./

quot. Bumke, 8).

Bumke investigated the state of the galvanic reflex as soon as the light reflex was definitely restored after a seizure. He found that the sensitivity of the iris to galvanic stimuli was much increased at this stage.

In the intervals between seizures, the condition of the pupils may present several interesting features. A certain degree of mydriasis is often found, but the administration of bromides may give rise to fallacy here. Anisocoria is not uncommon; it is usually transient, or it may alternate with equality of the pupils.

Fuchs (quot. Bumke, 8) concludes from a photographic analysis of the pupillary reactions in seven cases that the light-reflex in epileptics is characterised by an unusual activity both in quickness of response to stimulation and in amplitude of the movements of the iris.

Pupillary unrest is usually present, but in demented cases diminished or absent (Wassermeyer, quot. Bach, 2).

The sensitivity of the galvanic reflex was found to be increased in six cases examined by Bumke. The ratio between the intensity of current necessary to cause the sensation of light, and that necessary to produce reflex pupil-contraction, was 1 : 1.25. In healthy/

healthy subjects he had already found this ratio to vary between 1 : 1.5 and 1 : 4.0.

Albrand (1) has observed that the state of the pupils in epileptics may show considerable variation from time to time; their reactions may be now sluggish, now unusually brisk; and temporary oval or elliptical distortion may occur. The more marked transient anomalies are rare, and are found only among demented patients.

Epileptics, especially demented epileptics, on waking from physiological sleep may show a transient anisocoria; on one day the right pupil may be the larger, on another day the left; there may be irregularity of outline and corectopia. The pupils may already be unequally contracted in sleep, and they may not become equal for a considerable time after waking. There may be an unusual slowness in assuming or recovering from the initial dilatation on waking; one pupil may lag behind the other in contracting to the habitual medium size, so that a temporary anisocoria may be caused. (Albrand, 1.)

Eccentricity of the pupil is occasionally found in epileptics, persisting whether the pupil is contracted or dilated. Negro (20) has also observed it as a transient condition (functional corectopia) in many epileptics under examination in a dim light, when the accommodation/

accommodation is relaxed. The corectopia is seen to alter after a short time, especially in cases of hippus. The eccentricity disappears when the pupil contracts on exposure to light, or in near vision; also on the local application of a miotic, or a weak solution of cocaine. The symptom was present in from eight to ten per cent of Negro's epileptic cases, and only very rarely among non-epileptics.

Table VII (F and G) shows the condition of the pupils in 35 cases of acquired insanity with epilepsy, aged from 20 to 67.

The average diameter of the pupils of the cases below the age of 60 is 4.9 mm. The average pupil-diameter of nine cases before treatment with potassium bromide was 5.1 mm. The average pupil-diameter of 20 others was 4.8 mm. (Cases over the age of 60 are excluded.) It may be concluded that the effect of ordinary bromide treatment upon the pupil-diameter of epileptics is negligible. (The average dose given is 30 grains twice daily.) 16 cases have equal pupils, 8 show a trifling difference, and 10 show a difference in size of $\frac{1}{3}$ mm. or more.

In 17 cases, both pupils are circular; in the remaining 18 there is irregularity, usually in both eyes and of slight degree. In one case a change in the form of the pupils from circular to oval is recorded.

One/

One case showed diminution of the direct and consensual reflexes in both eyes.

Another case (No. 3) has no direct or consensual reaction to light in the left eye. The sensory reflex is also absent in both eyes. A satisfactory explanation of these symptoms has not been reached.

In 33 cases the direct light reflex was active in both eyes.

In all, five cases show loss of the sensory reflex, and nine cases show diminution.

On the whole, the most common symptoms are irregularity and inequality of the pupils. Loss or impairment of the sensory reflex occurs in an appreciable proportion of the cases, but otherwise the reflexes are not as a rule impaired .

Table VIII (G) gives the results of the examination of the pupils in 19 cases of imbecility with epilepsy. The age varies from 7 to 49. The average pupil-diameter is 5.3 mm. The average diameter in eight cases before bromide was administered proves to be 5.6 mm., but the average age of these is 24 as against 28 for the whole series. Here again the effect of bromide-treatment on the pupil-diameter appears to be negligible.

The pupils are equal in 13 cases, unequal in 6. 15 cases have circular pupils in both eyes, three cases have/

have both pupils irregular, one case has one pupil irregular.

One case shows diminished consensual reaction. Four cases show diminished near-vision reaction. This is probably due to lack of the power of full convergence associated with congenital deficiency of intellect.

In three cases absence of the sensory reflex is recorded, in five it is diminished.

On the whole, inequality and irregularity are not quite so common as in the last group, and the average pupillary diameter is slightly greater.

It should be stated that all the observations in tables VII and VIII were made in the intervals between fits, with the patients in their usual average mental condition.

5. Imbecility and Idiocy.

The light-reflex and near-vision reaction are usually unimpaired in imbeciles. In a very small percentage of cases the light-reflex is diminished.

Bumke found that the psychic reflex was often absent, but the reaction to painful stimuli was seldom altogether wanting. Out of 19 cases, Hübner found both the psychic and the sensory reflex present in 8, absent in 2 cases of low-grade type; one was a cretin girl. Wassermeyer observed loss of the psychic reflex and of pupillary unrest in one out of six cases/

cases, where the patient was a low-grade idiot. (Bach, 2; Bumke, 8.)

Koenig (14) observed marked pupillary anomalies only 13 times in 10 years, during which period he had examined several hundred imbecile children. One case showed "Springende Mydriasis" at irregular intervals in association with slight post-neuritic optic atrophy; at times the pupils were equal; the reflexes were active. In another case the right pupil reacted sluggishly to light (directly and consensually), and was rather larger than the left. The left eye was healthy. Congenital syphilis was excluded in both these cases.

The other eleven cases showed either absolute or reflex rigidity, complete or incomplete, in one or in both eyes. Only in one of these could syphilitic heredity with all likelihood be excluded. Five of them died from general paralysis, one from cerebral syphilis. Koenig distinguishes three clinical groups of cases among those with a history of parental syphilis; 1. non-paralysed idiots; 2. children suffering from infantile cerebral palsy proper; 3. juvenile general paralytics. Pupillary abnormalities may be present in any group; they are the rule in general paralysis, and occur in many cases of cerebral syphilis; they are the exception in infantile cerebral palsy/

palsy, and still more so among the non-paralysed idiots.

Malformations of the iris, which give an irregular form to the pupil, are not uncommon with idiots. (Ireland, "Mental Affections of Children.") Coloboma iridis and corectopia may be found.

In Table IX (H) I have recorded the condition of the pupil in four cases of "higher-grade" imbecility, aged from 19 to 47. Average diameter 4.8 mm. The pupils were unequal in one case; one other case had both pupils irregular, and one showed irregularity of the left pupil. The sensory reaction was sluggish in two cases.

In Table X (H) ten cases of imbecility of ordinary grade are recorded. Their ages vary from 19 to 41. The average pupil-diameter is 5.5 mm. The pupils were equal in six, slightly unequal in one, and they differed by $\frac{1}{2}$ mm. or more in three cases.

In four cases both pupils were circular, in five both were irregular, and one case had irregularity of one pupil. In No. 9, there is double congenital irregularity of the pupils, with diminution of the direct and consensual light-reflexes, and absence of sensory reaction in one eye; the pupils are also unequal.

In/

In six cases the sensory reaction is diminished; in one, it is absent in both eyes. One case shows diminished near-vision reaction in both eyes; in another the reaction was sluggish in the left eye.

In Table XI (H) there are eight cases of idiocy, aged from 18 to 45. The average diameter of the pupils is 5.7 mm. The pupils are equal in four cases, slightly unequal in one, differing by $\frac{1}{2}$ mm. or more in two. Both pupils are circular in six cases, one pupil slightly oval in one case. Four show diminished sensory reaction. The light-reflex is active in all the cases.

In tables IX, X, and XI there was no case which presented any marked degree of corectopia.

In the majority of the 22 cases in these three tables, the pupils were equal. In nine cases there was irregularity of one or of both pupils, and in a few the irregularity was marked. On the whole, a tendency to sluggishness of the sensory reaction is apparent.

The pupil-diameter tends to be larger in the lower grades than in the higher grades of mental deficiency.

6. Hebephrenia, Katatonia, and Paranoia.

Dementia praecox is the name given by many foreign alienists to a group of psychoses which have their onset/

onset as a rule between the ages of 15 and 30 years. They are characterised by a marked tendency towards early dementia, though the progress of the disease may be interrupted by remissions.

Originally Kraepelin grouped under this head three forms of mental disorder, namely hebephrenia, katatonia, and paranoid dementia. Other alienists have added further subdivisions, such as "simple primary dementia" and "mixed forms". One may gather that the scope of "dementia praecox" tends to become wider, and that the term may be used to include many cases of doubtful nature.

The opinion of L. C. Bruce (6) is that hebephrenia, katatonia, and paranoia are entirely separate diseases, and should be sharply distinguished from one another. With regard to paranoia, he remarks that as a rule there is little mental enfeeblement, except in a few of the adolescent cases, who deteriorate rapidly in mind and become demented and incoherent. We may regard the latter group as corresponding to Kraepelin's dementia paranoides.

Unfortunately writers on the pupillary symptoms of dementia praecox do not always define which disease they are dealing with. Hence many of their records are unsatisfactory from the present point of view, (as, for instance, in a paper by Tyson and Clark, 29).

Piltz/

Piltz (22) occasionally found in katatonic patients irregularity of the pupils, changing in form from day to day; transient sluggishness of movement of various portions of the iris; eccentricity of the pupil, subject to daily variation; varying degrees of anisocoria; mydriasis alternans; and increase in the activity of the light-reflex and orbicularis reaction.

Albrand (1) saw mydriasis with absolute rigidity in one case of dementia praecox in a state of katatonic excitement, as a temporary phenomenon. He quotes Meyer, who found "katatonic rigidity" of the pupil only once in 400 cases of dementia praecox. He concludes that absence of the light-reflex is quite an exceptional occurrence in that disease. Much more frequent symptoms he finds to be the following:- marked anisocoria with a difference of from 1 to 3 mm.; occasional irregularities of outline, usually in one eye only, with variations in the briskness and amplitude of the movements of the iris; increase in the degree of anisocoria and sometimes change in the form of the pupils as temporary phenomena in association with outbursts of excitement. The patients whom he examined were mostly in the stage of terminal dementia. He very rarely found see-saw pupils. Occasionally slight corectopia was observed in katatonic cases.

Albrand also points out that anisocoria is rendered/

rendered more evident when the pupils are examined under diminished illumination. In some cases in which the pupils are equal in ordinary daylight, inequality can be observed on examination in a subdued light.

Bumke (8) investigated 33 cases of dementia praecox, of whom 9 suffered from hebephrenia, 22 from katatonia, and 2 from paranoid dementia. He used a Westien corneal loupe, and an illumination of 7 metre-candles. There was no distinction between the three classes in respect of the size of the pupils; the average diameter was 6.5 mm. An unusual variation in the size of the pupils was observed six times; for instance, diameters of 8, 5.5, and 7 mm. respectively were found on three successive days in one case under similar conditions. Anisocoria was present in three cases. The near-vision reaction was normal, and the sensitivity of the galvanic pupil-reaction was high.

In the nine cases of hebephrenia, the psychical reflex and pupil-unrest were lost when the disease had lasted for some time and had led to a certain degree of dementia. In two cases these reactions were present, but only in the initial stage of the disease. In no case did they reappear when once lost. The sensory reflex was present only in two cases, which were examined at an early stage. In one case reappearance of the sensory reflex occurred along with markedmental improvement/

improvement.

In the 22 cases of katatonia, the psychical reflex and pupil-unrest were never present.

In 6 cases a slight dilatation was obtained from painful stimuli, but only in the early stage of the disease, or during a remission. An unusual activity of the lid-closure reaction was observed in 18 cases, the amplitude sometimes amounting to 2 or 3 mm.

Of the two paranoid cases, the sensory reflex was present in one only, and the psychical reflex and pupil-unrest in neither.

Bumke concluded that absence of the psycho-reflex, pupillary unrest, and the sensory reflex are typical of dementia praecox.

In a later communication, quoted by Bach (2), dealing with 200 cases of dementia praecox, Bumke states that he found these symptoms in 60 per cent of the whole, but that his hope of finding in them a reliable early indication of the disease had not been fulfilled.

Wassermeyer (quot. Bach, 2) examined 39 cases of dementia praecox with the Zeiss binocular microscope by daylight. Of these, 5 were hebephrenics, 25 katatonics, and 9 paranoiacs.

Of the 5 hebephrenic patients, in 2 cases pupil-unrest and the psycho-reflex were evident; in the other/

other three they were present but comparatively inactive. Among the katatonic patients, two out of nine stuporose cases showed almost complete absence of pupil unrest. In one out of five excited cases both pupil unrest and the psycho-reflex were absent. Of nine other katatonics, including two in a state of remission, seven showed both reactions distinctly.

Out of nine paranoiacs, pupillary unrest and the psychical reflex were absent in two. On the whole, six out of the 39 cases (15.4 per cent) showed loss of the psychic reflex and unrest.

For the purpose of comparison, Wassermeyer examined 174 soldiers, and found a great variety in the activity and range of movement of the pupils. In about 13 per cent pupil unrest was almost completely absent; in one case he found no trace of pupil-unrest or the psychical reflex.

He explains the difference between his results and those of Bumke by the higher power of magnification which he used. He concludes that the loss of pupil-unrest and the psychic reaction are to be referred principally to mental deterioration, although this loss may occur in dementia praecox before the dementia has become marked. Wassermeyer found no clinical difference between cases which show the symptoms in question and those which do not.

In/

In Table XII (H) I have given records of ten cases of hebephrenia, of between 17 and 41 years of age at the time of examination. The average pupil-diameter is 5.2 mm. The pupils were equal in seven cases; slight inequality was shown by one, more evident inequality by two. Both pupils were circular in six cases, both irregular in three; in one instance the left pupil was slightly elliptical, the right circular. There was loss of the sensory reflex in one case, and diminution in three.

Case No. 2 shows the development of corectopia and irregularity of the pupils, along with diminution of the sensory reaction and pupil-unrest. The patient's mental condition, however, was apparently undergoing improvement in the interval between the two observations.

Table XIII (J) contains the records of 17 cases of katatonia, varying in age from 15 to 38 years. The average pupil-diameter is 5.4 mm.

The pupils were equal in ten cases, slightly unequal in three; a difference amounting to $\frac{1}{2}$ mm. or more in size is shown by three cases. Both pupils were circular in six cases, both irregular in nine, one pupil irregular in two. Five cases showed loss of the sensory reaction in both eyes, in one instance as a temporary condition; six cases showed sluggishness of/

of the reaction in both eyes; in three only was the sensory reflex active. No. 1 shows improvement in the activity of the sensory reflex.

Pupil unrest was visible to the naked eye in at least seven cases, though in two of these its activity was diminished. In No. 17 it was absent, but reappeared.

Change in the outline of the pupils is seen in No. 1, 2, 12, and 17. Change in the size-relation of the pupils is seen in No. 2 and 17. The light-reaction is impaired in No. 2, 13, and 17.

Case No. 2 showed in October 1912 more rapidly alternating inequality, each pupil in turn becoming ½ mm. larger than the other, at intervals of a minute or two. The patient was then in a dull stuporose condition. On the 13th March 1913 the patient was in a state of marked katatonic stupor, the pupils were unequal and reacted sluggishly to light, and no sensory reaction or pupil unrest was visible to the naked eye.

Case No. 17 shows improvement in the state of the sensory reflexes and pupil-unrest, but diminution in the activity of the near-vision reaction.

On the whole, if it is permissible to draw deductions from such a small number of records, there is a rather greater tendency towards irregularity and inequality/

inequality of the pupils, and disturbance of the sensory reflex in katatonia than in hebephrenia.

Table XIV (J) deals with three cases of paranoia with dementia. Inequality of the pupils is twice recorded, and sluggishness of the sensory reflex twice.

Table XV (J) contains five cases of paranoia without marked tendency to dementia. The age varies from 48 to 74. There is inequality of the pupils in three cases, not exceeding ½ mm. in amount. Two cases in the senile period show irregularity of both pupils and sluggishness of the sensory reaction.

Diminished sensory reaction is also found in Case No. 2.

7. Melancholia of Involution.

Involution Melancholia is a psychosis of the involutional period of life characterised by great emotional depression, apprehension, and anxiety.

There are certain borderland cases of senile dementia with emotional depression that are difficult to distinguish from involution melancholia. Naturally melancholiacs after a prolonged duration may develop senile deterioration (White, 27).

Sluggishness of the light-reflex may be found in pre-senile psychosis; then there may be difficulty in/

in diagnosing the condition, because general paralysis may be developed even after the age of 60.

Table XVI (K) contains the records of 27 cases of melancholia originating in the involutional or pre-senile stage of life. There are 16 females, aged from 42 to 64 at the time of examination, and 11 males, aged from 43 to 65.

The average pupil-diameter of the whole series is 4.8 mm.; of those aged 60 and below, 4.9 mm.

The pupils are equal in seven cases; there is slight irregularity in 11; and a difference in size of ½ mm. or over in nine cases.

16 cases show bilateral irregularity; five cases have one irregular pupil; in six cases both pupils are circular.

The light-reflex is sluggish in both eyes in five cases; one case shows diminution in one eye only. One case (No. 25) has Argyll Robertson pupils; the patient is 61 years of age. Probably he has had syphilis; and he may in the end prove to be a general paralytic. Two other cases show loss of the sensory reaction, ten cases show diminution. Absence of pupillary unrest is recorded twice, diminution four times, and normal activity 15 times.

Change in the size-relation of the pupils is shown in No. 4, 7, 8, 9, 17, and 18; in No. 8 and 18 there/

there is reversal.

Change in the outline or position of the pupil took place in seven cases - No. 4, 8, 18; No. 3 and 17 (transient corectopia); No. 7 and 25 (transient elliptical outline).

In a majority of the cases therefore we find a slight degree of inequality (which may be inconstant), also slight unevenness of outline. Changes in the form and position of the pupils may occur. In a few cases there is sluggishness of the light reflex, and the sensory reflex may be inactive or even absent.

8. Senile Dementia.

In physiological old age, the diameter of the pupils is usually smaller than in middle age or youth. In about one-fourth of the cases marked miosis is to be found - the pupils being 2 mm. or less in diameter (Bumke,8). The reaction to sensory and psychical stimuli is present, but frequently sluggish, especially when there is miosis. The light reflex as a rule is not appreciably impaired, although in senile miosis the amplitude of the reaction is naturally small. The near-vision reaction is usually unaffected. Moebius (quoted by Bumke) on examining the eyes of 33 old people found marked miosis and absolute rigidity in three cases, and sluggishness of some of the reactions in/

in 19 of the remainder.

Other observers affirm that rigidity of the pupil due solely to old age never occurs (Bach, 2).

Bumke found that the galvanic pupil-reflex required a relatively much stronger current for its production in old age than in the earlier periods of life.

In senile dementia, the state of the pupils is on the whole similar to that in physiological old age, except that disturbances of the reactions are more common. Bach (2) summarizes the extant records as follows:- loss of the light-reflex is found in about 2 per cent of cases, absolute rigidity in 0.5 per cent; the reaction to light is reduced in about 4 per cent.

According to Bumke (8), the pupils in senile dementia have the following characteristics:- they are contracted, often markedly so; they react but slightly and sluggishly to light, and only slightly in near vision. There is no distortion of their outline, and anisocoria is rare; mydriasis and the typical Argyll Robertson symptom are never present apart from complications.

As the near-vision reaction is never quite intact, typical reflex-rigidity never occurs; but complete or incomplete absolute rigidity may be found, the former only in advanced old age (Bumke). The gradual development/

development of the symptoms of senile dementia may be subject to interruption and modification from the effect of more acute changes in the brain due to arteriosclerosis.

Haemorrhages or patches of softening may produce marked pupillary symptoms. There may be mydriasis or miosis in one eye or in both, and the mobility of the iris may be impaired or altogether lost.

The condition of the pupils in 16 cases of senile dementia is recorded in table XVII (L).

The age varies from 65 to 77. The average pupil diameter is 4.2 mm.

In two cases there are complications.

In No. 3 there is amaurotic rigidity associated with loss of vision in the left eye. In No. 4 there is loss of the direct and consensual light reflex in the left eye, impairment in the right eye; and bilateral loss of the sensory reflex. In none of the others is there any evidence of gross lesion. All suffered from more or less marked arteriosclerosis.

Five cases have equal pupils, four show slight inequality, seven show more marked inequality. Both pupils are irregular in 12 cases; two have irregularity of one pupil, and two have both pupils circular.

Relatively marked miosis is seen in No. 7 and 16. Apart from No. 3 and 4, eight cases exhibit bilateral diminution/

diminution in the direct and consensual light reactions, and in five of these the near-vision reaction is also sluggish. In nine observations, loss of the sensory reflex occurs twice, and diminution four times.

From this table it appears that in most cases the pupils are rather small, usually slightly irregular and differing slightly in size. Usually the light-reflex is sluggish, and in a certain number the near-vision reaction is sluggish as well. The sensory reflex may be impaired even when the reaction to light and near-vision is active.

These conclusions agree fairly well with the observations of Bumke, except with regard to the frequency of slight anisocoria and irregularity of the pupil.

9. Manic - depressive Insanity.

Seventy cases of manic-depressive insanity have been examined. The records appear in tables XVIII to XXII, sheets L, M, and N. There are 14 first-attack cases of melancholia, and four recurrent cases suffering from melancholia on admission. There are 13 recurrent cases suffering from mania on admission, and 17 first-attack cases of mania. These were all of short duration at the time of examination.

There were also 22 cases of "chronic mania" - in most/

most of which there is variation in the mental symptoms at longer or shorter intervals, occasional periods of apathy and depression, or of acute excitement; dementia is not a marked feature of the clinical picture in these 22 cases.

The 18 cases of melancholia will be taken together (tables XVIII, L: and XIX, M).

The age varies from 23 to 55. Average pupil-diameter 5.4 mm. The pupils are equal in eleven cases, they show slight inequality in five, more marked inequality in two.

Both pupils are circular in four cases; in one case one pupil was slightly irregular; in 13 cases both pupils showed irregularity, mostly of slight degree.

The light-reflexes (direct and consensual) were present and active in practically every case. In five cases the sensory reflex was diminished. Pupillary unrest is present as a rule. Case No. 7 (XVIII) showed loss of the sensory reflex.

On the whole, the pupils tend to be equal, and are often slightly irregular. Change in the size-relation and outline of the pupils is slight in amount. There may be diminution of the sensory reflex.

There are altogether 30 cases of mania in which the attack is of short duration. They are recorded in tables XX and XXI (M and N). The age varies from

20/

20 to 63. The average pupil-diameter is 5.4 mm. The pupils are equal in nine cases; there is slight inequality in ten cases, more evident inequality in ten cases.

Both pupils are circular in eleven cases, two cases show irregularity of one pupil, 16 cases of both pupils. Change in the pupil form (mostly slight) is seen in five cases. Transient corectopia is once recorded. The sensory reflex is usually present; its absence is recorded only twice. It is diminished in about half the cases.

In case No. 4 (XXI) the patient was depressed and emotional on admission, but she later developed a restless excited phase, in which the previously circular pupils became oval, and then returned to the circular form but with slight irregularities.

In No. 8 (XXI) improvement in the condition of the pupils was associated with improvement in the mental state; irregularity and inequality disappeared, and the sluggish sensory reflex regained its activity.

On the whole, slight irregularity and slight anisocoria are commonly found, and in a certain number the sensory reflex is sluggish. Change in these symptoms may accompany change in the mental state of the patient. The light reaction (direct and consensual) is practically never impaired; (in case No. 10, XX, arteriosclerosis and alcoholic excess are disturbing factors/

factors, which probably explain the sluggish reactions).

The average pupil-diameter is the same in the maniacal cases as in the melancholic cases; but anisocoria is perhaps more common in the former than in the latter.

Table XXII (N) contains 22 cases of chronic mania. The age varies from 30 to 60. The average pupil-diameter is 4.8 mm. In 18 cases the pupils are equal; in four there is slight inequality.

In 18 cases both pupils are circular. Three cases show bilateral irregularity, one case shows unilateral irregularity.

The light-reflex is active, except in one case. The sensory reaction is active in 11 cases, diminished in six, and once recorded as absent. The average pupil-diameter is considerably smaller than in the cases where the attack is of short duration.

On the whole, pupillary disturbances are but slight.

10. Terminal Dementia.

Table XXIII (N and O) shows the pupillary condition in 14 cases of advanced dementia.

The age varies from 40 to 74.

The average pupil diameter is 4.5 mm. Out of

12/

12 observations, equal pupils are recorded seven times, slightly unequal pupils five times.

In nine cases both pupils are circular; both are irregular in three cases, and one pupil is irregular in two cases.

The light reflex is not impaired. The sensory reflex is active in six observations, sluggish in three.

Beyond a gradual shrinkage in pupil diameter as age advances, no marked anomaly is recorded. Irregularity is not very frequent, slight anisocoria is rather more frequent.

CONCLUSIONS/

CONCLUSIONS.

After consideration of the published records and opinions, as well as the results of my own examination of insane patients, I have formed the following conclusions with regard to pupillary symptoms in mental diseases.

1. General paralysis presents a very large variety of pupillary phenomena, of which the most significant is the Argyll Robertson symptom. Absolute rigidity of the pupil is not so frequent or so significant as reflex rigidity. Most of the other symptoms may be regarded as leading up to or dependent on the development of one of those two conditions.

Many cases terminate before the light reflex becomes extinct. Reappearance of the light reflex when once it is lost, is a possible, but rare occurrence. On the whole, the more serious derangements of the iris are more frequent in the advanced stages of the disease.

2. Syphilitic insanity, if accompanied by vascular or syphilomatous disease implicating the nervous system, may present marked pupillary symptoms, which are not necessarily permanent. In the functional varieties of syphilitic insanity, pupillary symptoms are relatively slight and inconstant.

3./

3. Alcoholic insanity, the most common of the toxic psychoses, is often accompanied by disturbance of the pupils. In rare cases the pupil may not react to light; sometimes the sensory reflex is absent. Sluggishness of the light reflex or of all the reactions is not uncommon; irregularity and anisocoria are fairly frequent. All these symptoms may be subject to change.

4. Insanity with epilepsy presents well-marked pupillary symptoms in association with seizures; but the pupils of epileptics in their "habitual" state often show variations from the normal. These latter variations are in most cases inconstant, and some of them are functional in their nature.

5. Apart from the rare occurrence of marked congenital abnormalities, pupillary symptoms in imbecility and idiocy are usually unimportant. A slight degree of irregularity is occasionally present. The light-reflex is rarely impaired; the sensory and psychical reflexes may be diminished, occasionally absent.

6. In hebephrenia, diminution or loss of "unrest" and of the psychical and sensory reactions may be observed; there may be changes in the form and position of the pupils.

7. In katatonia, there is frequently diminution or loss/

loss of the sensory and psychical reactions and of unrest; temporary or changing irregularity, eccentricity, and inequality of the pupils are often present. Variation in the activity of the light-reaction may occur, usually a diminution.

8. The sensory reaction may be diminished in paranoia, especially where there is a certain degree of dementia.

9. In melancholia of involution a slight degree of inequality and irregularity of the pupils is often perceptible. Changes in the form, position and size-relation of the pupils may occur. In a few cases the light-reflex is sluggish, and the sensory reaction may be inactive, rarely absent.

10. The pupils in senile dementia tend to be small, usually reacting somewhat sluggishly to light; the near vision reaction may also be impaired. The sensory reflex is occasionally absent; it may be impaired when the light and near-vision reflexes are active.

11. The melancholic phase of manic-depressive insanity presents but few pupillary symptoms. Slight irregularity is not uncommon; anisocoria is relatively infrequent. If there is change in the form or size-relation of the pupils, it is slight in amount. The sensory reflex is sluggish in a few cases only.

In the maniacal phase, slight irregularity and inequality/

inequality of the pupils are frequently observed. In a certain number of cases the sensory reflex is sluggish. Change in these symptoms may accompany change in the mental state.

The average pupil-diameter is the same in the melancholic as in the maniacal phase.

The pupil-diameter is smaller on the whole in patients who are habitually in a state of excitement. Here there are no marked pupillary disturbances. In a small proportion of cases the sensory reflex is sluggish.

12. In terminal dementia, irregularity of the pupil is not very common. Slight anisocoria is rather more frequent. As age advances, the influence of senility on the condition of the pupils gradually makes itself felt.

13. Apart from general paralysis, epilepsy, and gross brain-lesions, the more evident pupillary symptoms are found in the toxic psychoses and in senile dementia. In katatonia and the habitual condition of insane epileptics, transient sluggishness of the light reaction may be observed.

In many kinds of insanity there is a tendency towards variation in the form, position, and size-relation of the pupils.

14./

14. Diminution and loss of the sensory and psychical reactions and of pupil-unrest are typically frequent, it has been claimed, in the triad of diseases included in the term dementia praecox. These symptoms however, are not uncommon in other types of insanity; and no special diagnostic importance can be attached to their occurrence.

15. Further investigation of the condition of the pupils in insane patients is required. Each case should be re-examined at regular intervals, and control-observations of a sufficiently large number of healthy persons should be carried out under similar conditions.

METHOD/

METHOD OF EXAMINING THE PUPILS.

Insane patients sometimes do not submit kindly to methodical examination. Either timidity, suspicion, resistiveness, inattention, or lack of intelligence on the patient's part may demand the exercise of much tact and patience on the part of the observer. He may find it impossible to make any but disjointed observations, which may be vitiated by reactions associated with restless movements of the patient's eyes or eyelids.

I have found it most satisfactory to use only comparatively simple appliances, and as few of these as possible.

The patients were examined in dull diffused daylight, both eyes being equally illuminated. Each patient was asked to look steadily at some definite object in the distance. The lighting was such that the outline of the pupils could be clearly seen, but bright daylight or sunshine was avoided. One result of this is, that except where the pupils are rigid to light, the sizes recorded in the tables cannot be compared with the "physiological diameter" as estimated by Schirmer. The measurements in the tables however were made as far as possible under the same conditions and may be regarded as comparable among themselves. Another drawback is that the sensory reflex/

reflex is not so clearly evident as it is with brighter illumination, but in doubtful cases re-examination before a window can be carried out. On the other hand, examination in a comparatively dull light enables one to appreciate differences in size and irregularities of form which are not always so clearly seen with brighter illumination.

For measuring the diameter, I found it best to compare the pupil with a series of black circular discs marked on a strip of white cardboard. This simple pupillometer, held close to the patient's temple on the same level as the eye, does not distract his attention so much as would an instrument held in front of the eye. The series of discs differ in size by $\frac{1}{2}$ mm., and it is possible by comparison to judge intermediate sizes, so that one can practically estimate the diameter of the pupil to the fourth part of a millimetre. A black disc on a white ground appears smaller than a black disc on a somewhat dark background; this effect of irradiation may lead to over-estimation of the size of the pupil in patients with dark irides, but the error would not amount to more than $\frac{1}{4}$ mm. In order to minimize the tendency to error, a series of discs marked on grey cardboard might be used.

For testing the light-reflex, I used a pocket electric flash-lamp or a small surgical hand lamp connected/

connected to a dry battery. In either case a bright light is produced by pressure on a button, and the strength of illumination can be graduated as required by varying the distance between the lamp and the patient's eye.

In testing the sensory reaction, painful sensation was produced by the pressure of a blunt needle on the patient's skin. In cases where the psychical reflex is active, the mere approach of the needle if observed by the patient is sufficient to produce a marked dilatation of the pupils.

The pupillary unrest was estimated by the naked eye. The ordinary corneal loupe does not give a sufficiently large field of view, and a Zeiss binocular microscope was not available. In any case only a certain number of patients could be satisfactorily examined with this instrument.

Finally, I wish to express my thanks to Dr. Kay, the former Medical Superintendent of Wadsley Asylum, and Dr. Vincent, his successor, for kindly granting special facilities for the examination of patients for the purposes of this thesis.

NOTES ON THE SYMBOLS USED IN THE TABLES.

In the records given in the following series of tables, the sign + indicates that the reaction in question is present and active, the sign - indicates that it is present but with diminished activity, and O means that the reaction is absent, or at any rate not appreciable to the naked eye.

(The term "corectopia" is used in the general sense as explained on page 10.)

A

	No.	Sex	Age	Size of Pupils in Mm. R	L	Reaction to Light Direct R	L	Reaction to Light Consens. R	L	Reaction to Near Vision R	L	Reaction to Sensory Stimuli R	L	Pupillary Unrest R	L	Outline of Pupils Right	Left	Date.
I	1	M	34	5	5	+	+	+	+	+	+	+	+	+	+	Circular	Circular	
Temporary Alcoholic Insanity - page 50.	2	M	34	5½	5½	+	+	+	+	+	+	−	−			Slightly irregular	Irregular	
	3	M	40	5¾	5½	−	−	−	−	+	+	+	+			Slightly irreg.: Corectopia	Slightly irregular	
	4	M	40	6½	6	+	+	+	+	+	+					Circular	Somewhat elliptical	
	5	M	42	5½	6	+	+	+	+	+	+					Slightly irreg. + elliptical	Slightly irregular.	
	6	M	42	5	4½	+	+	+	+	+	+	+	+			Circular	Slightly irregular.	
	7	M	48	4	3½	+	+	+	+	+	+	−	−			Circular	Slightly irregular.	
	8	M	53	4½	5½	+	+	+	+	+	+					Slightly irregular	Slightly irregular.	
	9	M	55	4¼	4½	−	−	−	−	−	−	+	+			Slightly irregular	Slightly irregular.	
	10	M	60	5¼	4¾	−	−	−	−	+	+	+	+	+	+	Slightly irregular	Circular.	
II	1	M	28	5¼	5	+	+	+	+	+	+	0	0			Circular	Circular	26.12.12
Polymorphic Alcoholic Insanity - page 52.				5¾	6¼	+	+	+	+	+	+	−	−			Irregular	Circular	5.2.13
	2	M	39	3½	3½	−	−	−	−	+	+	0	0			Slightly irregular	Somewhat pear-shaped	28.12.12
				5¼	5¾	+	+	+	+	+	+	−	−			Irregular	Irregular	28.1.13
				4	4½	+	+	+	+	+	+	−	−			Irregular	Irregular	5.2.13
III	1	M	36	6	5½	+	+	+	+	+	+	0	0			Circular	Slightly flattened.	
Chronic Alcoholic Insanity - page 53.	2	M	40	5	5¼	−	−	−	−	−	−	−	−			Circular	Circular	
	3	M	40	4	4½	+	+	+	+	+	+	−	−			Circular	Circular	
	4	M	41	3¾	3¾	−	−	−	−	−	−	0	0			Irregular	Slightly irregular	
	5	M	41	5½	5¾	+	+	+	+	+	+	+	+	+	+	Circular	Circular	
	6	M	43	5½	5½	+	+	+	+	+	+	−	−			Slightly irregular	Circular	2.11.12
				4¾	5¾	+	+	+	+	+	+	0	0	0	0	Slightly irregular	Irregular	13.2.13.
	7	M	46	5¼	5¼	−	+	−	+	+	+	0	0			Slightly irregular	Slightly irregular	
	8	M	47	6¼	6	+	+	+	+	+	+	−	−	+	+	Circular	Circular	
	9	M	49	5¼	5¼	+	−	+	−	+	+	−	−			Irregular, 3-cornered	Irregular	
	10	M	53	2¾	2½	+	+	+	+	+	+	+	+	−	−	Circular	Slightly irregular	
	11	M	54	5	4½	−	−	−	−	+	+					Circular	Circular	25.4.12
			55	4¾	5¼	+	+	+	+	+	+			+	+	Slightly irregular	Slightly irregular	14.2.13
	12	M	56	5	4¾	−	−	−	−	+	+	+	+			Irregular	Elliptical	11.11.12
				4¾	4½	−	−	−	−	+	+	+	+	0	0	Slightly irregular	Irregular	11.3.13
	13	M	56	4	4	+	+	+	+	+	+	0	0			Circular	Circular	
	14	M	57	4½	4¾	−	−	−	−	−	−	0	0			Slightly irregular	Slightly irregular	16.8.12
				3½	4	−	−	−	−	−	+	−	−			Circular	Slightly irregular	5.11.12
	15	M	57	4¼	4	+	+	+	+	+	+					Irregular	Irregular	
	16	M	58	3¾	3¼	−	−	−	−	−	−	−	−			Irregular	Irregular	
	17	M	59	4	4¾	+	+	+	+	+	+					Irreg. oval: corectopia.	Irregular oval.	

A

B

	No.	Sex	Age	Size of Pupils in Mm. R	L	Reaction to Light Direct R	L	Reaction to Light Consens. R	L	Reaction to Near Vision R	L	Reaction to Sensory Stimuli R	L	Pupillary Unrest R	L	Outline of Pupils. Right	Left	Date.
III continued - Chronic Alcholic Insanity	18	M	61	6	6×5¼	−	+	−	+	+	+	−	−	+	+	Slightly irregular	Irregular, oval.	
	19	M	62	3½	3¾	+	+	0	+	+	+	−	−			Irregular	Irregular	
	20	M	62	4	4	−	−	−	−	+	+	+	+			Circular	Circular	
	21	M	64	3½	3¾	−	−	−	−	−	−	−	−	0	0	Slightly irregular	Slightly irregular	
	22	F	41	4½	3½	+	+	+	+	+	+	−	−			Circular: corectopia	Circular	
	23	F	50	4	4	+	+	+	+	+	+	+	+			Irregular	Irregular	
	24	F	56	4	4	+	+	+	+	+	+	+	+			Circular	Circular	
	25	F	58	4	4¼	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular.	
	26	F	60	3½	3½	+	+	+	+	+	+	−	−			Circular	Circular	
IV Ins. from Lead Poisoning - page 55.	1	M	65	5	4½	+	+	+	+	+	+	−	−	+	+	Irregular	Irregular	13.3.12
			66	4¼	4×3¾	−	−	−	−	+	+	−	−	0	0	Irregular	Irregular, oval.	7.3.13
V Syphilitic Insanity - page 46.	1	M	17	5¾	5½	+	+	+	+	+	+	+	+	+	+	Circular	Circular	
	2	M	19	5½	5½	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular	
	3	M	25	7	5½	+	+	+	+	+	+					Somewhat oval	Irregular	10.1.13
				6¾	5½	+	+	+	+	+	+	+	+	+	+	Irregular	Circular	7.2.13
	4	M	32	6×5½	5¼	−	+	−	+	+	+	+	−			Irregular, elliptical	Slightly irregular	
	5	M	40	6¼	6¼	+	+	+	+	+	+	−	−			Circular	Circular: corectopia	2.3.12
			41	5¾	5½	+	+	+	+	+	+	+	+	+	+	Circular	Circular: corectopia	13.2.13
	6	M	42	5	5	+	+	+	+	+	+	−	−			Circular	Circular	
	7	F	37	R<L		−	−	0	0									−.1.90
			57	4	4½	+	+	0	0	+	+	0	0			Circular	Circular	31.5.10
VI General Paralysis - page 39.	1	F	39	3½	4	0	0	0	0	+	+	0	0			Irregular	Irregular	
	2	F	49	4	3¾	0	0	0	0	+	+	−	−	−	−	Oval	Circular	
	3	F	58	R=L		0	0	0	0	−	−					Circular	Oval	3.12.09
			59	3	3¼	0	0	0	0	−	−	−	−			Irregular	Irregular	9.11.10
				3½	3¾	0	0	0	0	+	+	0	0			Irregular	Irregular	23.11.10
	4	M	46	4½	4½	−	−	−	−	+	+	−	−			Irregular	Circular	21.10.12
				4¾	4½	0	0	0	0	+	+	0	0					13.12.12
				4	4¼	0	−	0	−	+	+	−	−			Irregular	Irregular	28.1.13
				3½	3	0	0	0	0	+	+	0	0	0	0	Irregular	Irregular	27.2.13
	5	M	39	3¾	4¼	0	0	0	0	+	+	0	0			Irregular	Oval; irregular	27.8.12
			40	3½	4	0	0	0	0	+	+					Irregular	Irregular	22.10.12
				4	4⅛	0	0	0	0	+	+					Irregular	Oval: irregular	21.11.12
	6	M	51	4¾	4¾	0	0	0	0	+	+	0	0			Circular	Circular	
	7	M	51	3	4	0	0	0	0	+	+	0	0			Irregular	Irregular	

B

C

VI continued – General Paralysis.

No.	Sex	Age	Size of Pupils in Mm.		Reaction to Light				Reaction to Near Vision		Reaction to Sensory Stimuli		Pupillary Unrest		Outline of Pupils		Date.
					Direct		Consens.										
			R	L	R	L	R	L	R	L	R	L	R	L	Right.	Left.	
8	M	35	4¾	4¾	0	0	0	0	+	+	–	0			Slightly irregular	Slightly irregular	8.10.12
			4¼	4¾	0	0	0	0	+	+	0	0			Irregular	Irregular	19.12.12
9	M	53	2½	2¾	0	0	0	0	+	+	0	0			Slightly irregular	Slightly irregular	12.10.12
			2½	2¾	0	0	0	0	+	+	0	0			Circular	Slightly irregular	22.10.12
			2½	2¾	0	0	0	0	+	+	0	0			Irregular	Irregular	13.12.12
			2¾	2½	0	0	0	0	+	+	0	0			Irregular	Irregular	5.2.13
10	M	41	R < L		+	+			+	+							10.8.05
		48	5	6	0	0	0	0	+	+	0	0			Circular	Slightly irregular	22.10.12
			5½	5¾	0	0	0	0	+	+	0	0			Irregular, oval.	Approx. circular	13.12.12
11	M	49	3	3	0	0	0	0	+	+	0	0	0	0	Irregular	Irregular	
12	M	37	6	5½	0	–	0	+	+	+					Irregular	Irregular, oval.	24.10.12
			5¾	5½	0	–	0	–	+	+	0	0			Very irregular	Very irregular	19.12.12
			5¼	4¾	0	0	0	0	+	+	–	–			Irregular	Very irregular: crenated	28.1.13
			5½×5	5¼	0	0	0	0	+	+	0	0	0	0	Irregular, elliptical	Very irregular.	27.2.13
13	M	47	2	2¼	–	–	0	0	+	+	0	0			Irregular, crenated	Irregular, oval.	27.10.11
		48	2½	2½	0	0	0	0	+	+	0	0			Irregular, flattened.	Very irregular, oval.	7.11.12
14	M	53			–	–	–	–	+	+					Irregular.	Roughly quadrilateral	7.9.11
		54	4¾	4	0	0	0	0	–	–					Irregular.	Irregular, oval	24.10.12
			4½	3½	0	0	0	0	+	+					Irregular.	Elliptical	21.11.12
15	M	50	2½	2¼	0	0	0	0	+	+	0	0			Irregular.	Slightly irregular.	27.8.12
			2¼	2	0	0	0	0	+	–	0	0			Approx. circular.	Approx. circular.	22.10.12
			2½	2	0	0	0	0	+	+	0	0			Irregular	Irregular	21.11.12
16	M	49	6½	6	0	0	0	0	+	+	0	0			Oval	Pear-shaped	10.9.12
			6	5½×5	0	0	0	0	+	+	0	0			Slightly irregular	Oval.	22.10.12
			6¼	5	0	0	0	0	0	+	0	0			Irregular	Irregular	13.12.12
			6½	5½	0	0	0	0	+	+	0	0			Irregular	Irregular	28.1.13
			6¼	5¼	0	0	0	0	+	+	0	0	0	0	Irregular	Irregular, flattened.	27.2.13
17	M	63	5¼	5¼	0	–	0	–	+	+					Slightly irregular	Slightly irregular	18.1.13
			4¼	4½	0	0	0	0	+	+	0	+	0	–	Irregular	Irregular	12.2.13
18	M	37	2¾	3	–	0	0	0	+	+	0	0	–	–	Irregular: corectopia.	Irregular: corectopia	
19	M	49	4¼	4½	–	+	–	+	+	+	–	–			Oval	Roughly quadrilateral	25.9.12
			3¾	4	0	–	0	–	–	–	0	0			Approx. circular	Approx. circular	24.10.12
			4	5	–	–	–	–	–	–	–	0			Slightly irregular	Irregular	19.12.12
			3¾	4½	0	+	0	+	+	+	0	+	0	–	Approx. circular	Slightly irregular	14.2.13
20	M	54	7¼	6½	0	–	0	–	+	+	0	–	0	–	Irregular	Irregular	
21	M	55	3¾	4¼	–	–	–	–	+	+	0	0			Irregular	Irregular	22.11.12
			3¾	4	0	–	–	0			0	0			Irregular	Irregular	28.1.13
			4¼	4	0	–	0	–	+	+					Slightly irregular	Slightly irregular	27.2.13

C

D

VI continued - General Paralysis.

No.	Sex	Age	Size of Pupils in MM. R	Size of Pupils in MM. L	Reaction to Light: Direct R	Reaction to Light: Direct L	Reaction to Light: Consens. R	Reaction to Light: Consens. L	Reaction to Near Vision R	Reaction to Near Vision L	Reaction to Sensory Stimuli R	Reaction to Sensory Stimuli L	Pupillary Unrest R	Pupillary Unrest L	Outline of Pupils: Right	Outline of Pupils: Left	Date.
22	F	53	2¾	2	−	0	−	0	+	+	0	0	0	0	Irregular	Irregular	
23	M	43	4¾	5¼	+	+	+	+	+	+					Slightly irregular	Slightly irregular	27.8.12
			3½	3½	0	−	0	−	+	+	0	0			Roughly quadrilateral	Roughly elliptical	22.10.12
24	M	41	5	4½	0	0	0	0	+	+	0	0			Irregular	Circular	27.8.12
			5½	5	0	+	−	+	+	+	0	0			Very irregular	Slightly irregular	29.10.12
25	M	37	5½	5½	+	+	+	+	+	+	+	+			Slightly irregular	Circular	2.1.12
		38	5¾	5½	−	−	−	−	+	+	−	−			Slightly irregular	Circular	7.11.12
			5¼	5¼	−	−	−	−	+	+	−	−	−	−	Irregular	Circular	13.2.13
26	M	66	4	3¾	−	−	−	−	+	+	−	−			Slightly irregular	Slightly irregular	
27	M	38	6½	6	−	−	−	−	+	+	+	0			Slightly irregular	Circular	
28	M	47			+	+	+	+							Oval	Oval	6.12.10
		49	4	4	−	−	−	−	+	+					Circular	Slightly irregular: oval	11.11.12
29	M	53	R<L		−	−	−	−	+	+					Oval	Oval	17.2.11
		55	3	4½	−	−	−	−	+	+	0	0	0	0	Slightly crenated	Very irregular.	7.3.13
30	M	42	Very Small	Very Small	0	0	0	0	0	0					Slightly irregular	Slightly irregular	6.8.09
		45	4	3¾	−	−	−	−	+	+	0	0			Slightly irregular	Slightly irregular	7.11.12
31	M	36	R=L		+	+			+	+							·07
		41	5	4½	−	−	−	−	+	+	−	−			Slightly irregular	Irregular	19.12.12
32	M	61	4	3¼	−	−	−	−	−	−	−	−			Irregular	Irregular	8.10.12
			4	3¾	−	−	−	−	+	+	−	−			Irregular	Irregular	24.10.12
33	M	38	5½	6¼	−	−	−	−	+	+	0	0			Slightly irregular.	Slightly irregular: oval	4.12.12
			4¾	5¼	−	−	−	−	+	+	0	0			Irregular	Irregular	5.2.13
			3½	5	0	0	0	0							Corectopia	Corectopia	13.3.13 (seizure)
34	M	52	4½	4	−	−	−	−	+	+					Slightly irregular.	Slightly irregular.	13.1.13
			5¼	5¼	−	−	−	−	+	+	0	0			Irregular	Irregular	28.1.13
35	M	62	4¼	4½	−	−	−	−	+	+	0	0			Irregular	Irregular	
36	M	42	4½	4½	−	−	−	−	+	+					Irregular	Irregular	
37	M	40	6	6¾	+	+	+	+	+	+	0	0			Irregular, crenated.	Circular	9.10.12
			5¼	6	−	−	−	−	+	+	0	0			Slightly irregular	Oval	29.10.12
			6×5½	5¾	−	−	−	−	+	+	0	0			Irregular, oval.	Irregular.	21.11.12
38	M	40	6	5¾	+	+	+	+	+	+	+	+			Slightly irregular.	Circular.	30.4.12
			4½	4¼	−	−	−	−	+	+	+	+			Circular	Slightly irregular	24.10.12
			5¼	5¼	+	+	+	+	+	+					Slightly irregular	Slightly irregular	21.11.12
39	M	39	R<L		−	−	−	−							Irregular, oval.	Irregular, Oval.	27.3.11
		40	3¾	4	−	+	−	−	+	+					Slightly irregular	Slightly irregular	24.10.12
			4½	4¾	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular	19.12.12
		41	4	4¾	−	−	−	−							Slightly irregular	Slightly irregular	14.2.13
40	M	40	3¾	5×1½	0	0	0	0	0	0	0	0			Irregular	Irregular, oval.	

E

VI continued - General Paralysis.

No.	Sex	Age	Size of Pupils in MM. R	Size of Pupils in MM. L	Reaction to Light: Direct R	Reaction to Light: Direct L	Reaction to Light: Consens. R	Reaction to Light: Consens. L	Reaction to Near Vision R	Reaction to Near Vision L	Reaction to Sensory Stimuli R	Reaction to Sensory Stimuli L	Pupillary Unrest R	Pupillary Unrest L	Outline of Pupils: Right	Outline of Pupils: Left	Date.
41	M	38	3¾	3½	0	0	0	0	0	0					Irregular	Irregular	
42	M	54	3¾	5x1½	0	0	0	0	0	0	0	0	0	0	Circular	Irreg. elliptical	
43	M	60	3½	3¾	0	0	0	0	0	0					Slightly irregular	Slightly irregular.	
44	M	15	7½	6½	0	0	0	0	0	0	0	0			Corectopia, irregular.	Corectopia, irregular	28.12.12
			7	6	0	0	0	0	0	0	0	0			Corectopia, irregular.	Corectopia, irregular.	28.1.13
45	M	58	R<L		—	0									Very irregular	Very irregular	27.5.12
			4¼	5¼	—	—	—	0	+	0	—	0			Circular	Oval	24.10.12
			3½	5¼	0	0	0	0	—	—	0	0			Circular	Very irregular	5.11.12
			4	4¾	0	0	0	0	+	0	0	0			Irregular	Irregular	13.12.12
			4½	5¼	0	0	0	0	+	0	0	0			Slightly irregular	Irregular	28.1.13
46	M	37	4½	5¼	—	0	—	0	+	—	—	0			Oval	Roughly triangular.	14.12.12
			4¼	4¾	—	0	—	0	+	—	0	0	0	0	Irregular	Irreg. triangular.	14.2.13
			4¼	5	—	0	—	0	+	—	0	0	0	0	Irregular	Irreg. triangular	7.3.13
47	M	59	3¾	3¼	—	—	—	—	—	—	+	+			Slightly irregular	Slightly irregular.	20.8.12
			4	4	+	+	—	—	—	—	—	—			Irregular	Irregular	8.10.12
			3½	3½	—	—	—	—	—	—	—	—			Slightly irregular	Circular	22.10.12
			4	4	—	—	—	—	—	—	0	0			Circular	Irreg. flattened	13.12.12
48	M	35	5	4¾	+	—	+	—	+	+	—	—			Circular	Circular	
49	M	43	4¾	4¾	—	+	—	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular.	
50	M	32	6	6	—	+	—	+	+	+	0	0			Slightly irregular	Slightly irregular	7.11.12
			6½	6¾	+	—	+	—	+	+	0	0			Irregular	Irregular	19.12.12
			6½	6½	+	+	+	+	+	+	0	0			Irregular	Irregular	28.1.13
			5¼	5½	+	+	+	+	+	+	0	0			Slightly irregular	Slightly irregular	5.2.13
51	M	41	5x4½	4¼	+	—	+	—	+	+	0	0			Elliptical	Slightly irregular	
52	M	36	5	3¾	+	+	0	0							Irregular, Oval.	Irregular, flattened.	
53	M	32	7¼	7	+	+	+	+	+	—	0	0			Irregular	Irregular	10.12.12
			5½	5¾	+	+	+	+	+	+	+	+	+	+	Corectopia: circular	Corectopia: circular.	13.2.13
54	M	47	4¾	5	+	+	+	+	+	+	0	0	0	0	Irregular	Irregular	9.2.13
			4½	5¼	+	+	+	+	+	+	—	—	+	+	Corectopia: irregular.	Irregular.	12.2.13
55	M	32	5½	6x5½	+	+	+	+	+	+	—	—			Slightly irregular.	Irregular: elliptical	26.12.12
			5¼	5½	+	+	+	+	+	+	+	+	+	+	Irregular	Irregular	14.2.13
56	M	42	3¼	3	+	+	+	+	+	+	—	—			Slightly irregular	Slightly irregular	
57	M	44	5¾	5¼	+	+	+	+	+	+	0	0			Slightly irregular	Slightly irregular	
58	M	31	5¼	5½	+	+	+	+	—	—	0	0			Circular	Irregular	24.10.12
			5½	6½	+	+	+	—	+	+	0	0			Irregular	Irregular	28.1.13
59	M	44	4¼	4¼	+	+	+	+	+	+	—	—			Slightly irregular	Slightly irregular.	24.10.12
			4¼	4¼	+	+	+	+	—	—					Elliptical	Pear-shaped.	19.12.12
			4½	4¼	+	+	+	+	—	—	—	—	—	—	Slightly irregular	Slightly irregular	14.2.13

F

VI continued - General Paralysis.

No.	Sex.	Age	Size of Pupils in MM. R	L	Reaction to Light: Direct R	L	Consens. R	L	Reaction to Near Vision R	L	Reaction to Sensory Stimuli R	L	Pupillary Unrest R	L	Outline of Pupils: Right	Left	Date.
60	M	35	5½	5	+	+	+	+	+	+	−	−			Circular	Circular	29.10.12
			4	4½	+	+	+	+	+	+	−	−			Oval	Irregular	21.11.12
			5	5½	+	+	+	+	+	+	−	−	−	−	Irregular	Irregular	12.2.13
61	M	42	R<L		+	+	+	+	+	+	+	+			Irregular	Circular	23.1.12
			5½	6	+	+	+	+	+	+	+	+			Slightly irregular	Circular	19.12.12
		43	4¼	5¼	+	+	+	+	+	+	+	+	+	+	Irregular	Slightly irregular	7.3.13
62	M	40	5½	5½	+	+	+	+	+	+	+	+			Corectopia: irregular.	Corectopia: irregular.	25.1.12
		41	5¼	4¾	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Irregular.	7.3.13.
63	M	38	6	6¼	+	+	+	+	+	+	−	−			Slightly flattened	Oval.	8.10.12
			5	5½	+	+	+	+	+	+	−	−			Slightly irregular.	Slightly elliptical.	7.11.12
64	M	47	4	4×3½	+	+	+	+	+	+	0	0			Circular	Flattened below.	
65	F	44	5	4½	+	+	+	+	+	+	−	−			Circular	Circular	
66	M	18	4¼	3½	0	0	0	0	?0	?0	0	0			Irregular	Irregular	22.3.12
			4½	3½	0	0	0	0	?0	?0	0	0			Slightly irregular.	Slightly irregular.	1.8.12
67	M	67	R>L		−	−	−	−									24.4.11
		68			−	−											5.7.12
			3½	3½	3¾	3¾	0	0	+	+	0	0			Slightly irregular.	Irregular.	13.12.12
		69	3	3	3¼	3¼	0	0	0	0					Irregular	Irregular	5.2.13
			3¼	3	3½	3¼	0	0	−	0	0	0	0	0	Irregular	Slightly irregular	12.2.13

VII Insanity with Epilepsy - page 61.

1	F	20	5½	5½	+	+	+	+	+	+	+	+	+	+	Circular	Circular	8.11.11
			6	6	+	+	+	+	+	+	+	+	+	+	Oval	Somewhat oval	28.11.11
2	F	20	5	5	+	+	+	+	+	+	+	+			Circular	Circular	
3	M	22	7	6¼	+	0	+	0	+	+	0	0			Circular	Oval	
4	F	23	5½	5½	+	+	+	+	+	+	−	−			Circular	Circular	
5	F	24	4¼	4½	+	+	+	+	+	+	+	+	+	+	Circular	Circular	
6	F	29	5½	5½	+	+	+	+	+	+	+	+			Circular	Circular	
7	F	29	5½	5½	+	+	+	+	+	+	+	+	+	+	Circular	Circular	
8	F	30	5¼	5½	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular	
9	F	37	5	5	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular	
10	F	37	4¾	5½	+	+	+	+	+	+	+	+			Irregular.	Irregular, oval.	
11	M	37	4¾	5	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular	
12	M	38	5¼	6¼	+	+	+	+	+	−	0	0			Circular	Circular	
13	F	39	5	5	+	+	+	+	+	+	0	0			Circular	Circular	
14	F	40	5½	5½	+	+	+	+	+	+	+	+			Circular	Circular	
15	F	41	4	4	+	+	+	+	+	+	+	+			Circular	Circular	
16	M	41	5½	4¾	+	+	+	+	+	+	+	+			Irregular	Irregular	
17	F	43	4½	4½	+	+	+	+	+	+					Circular	Circular	

Date.

VII continued - Insanity with Epilepsy.

No.	Sex	Age	Size of Pupils in Mm. R	L	Reaction to Light Direct R	L	Reaction to Light Consens. R	L	Reaction to Near Vision R	L	Reaction to Sensory Stimuli R	L	Pupillary Unrest R	L	Outline of Pupils Right	Left
18	F	43	4½	4½	+	+			+	+	0	0			Slightly irregular	Slightly irregular
19	F	46	4	4	+	+			+	+	+	+			Circular	Circular
20	F	46	4½	4¼	+	+			+	+	+	+			Circular	Circular
21	F	47			+	+			+	+	0	0			Irregular	Irregular
22	F	50	5	5	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular.
23	F	50	4	3¾	+	+	+	+	+	+	+	+			Circular	Circular
24	F	51	5¼	5¾	+	+	+	+	+	+	+	+			Slightly irregular	Slightly oval.
25	F	51	5	4¾	+	+	+	+	+	+	+	+			Slightly irregular	Circular
26	M	52	4¼	4	−	−	−	−	+	+					Slightly irregular	Slightly irregular
27	F	52	4¼	4¼	+	+	+	+	+	+	+	+			Circular	Slightly irregular
28	F	53	4¾	5	+	+	+	+	+	+	−	−			Circular	Oval, slightly irregular.
29	F	57	5¼	5½	+	+	+	+	+	+	+	+			Circular	Circular
30	M	57	3½	4	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular
31	F	63	4	4	+	+			+	+	+	+			Slightly irregular	Slightly irregular
32	F	64	4	4½	+	+			+	+	−	−			Circular	Circular
33	F	64	4	3½	+	+	+	+	+	+	−	−			Circular	Slightly irregular.
34	F	66	3½	4	+	+	+	+	+	+	+	+			Slightly irregular	Circular
35	F	67	4	4	+	+	+	+	+	+	−	−			Corectopia - in	Corectopia - in.

VIII Imbecility with Epilepsy - Page 62.

No.	Sex	Age	Size of Pupils in Mm. R	L	Reaction to Light Direct R	L	Reaction to Light Consens. R	L	Reaction to Near Vision R	L	Reaction to Sensory Stimuli R	L	Pupillary Unrest R	L	Outline of Pupils Right	Left
1	M	7	6½	6½	+	+	−	−	−	−	+	+	+	+	Circular	Circular
2	M	13	6½	6½	+	+	+	+	+	+			+	+	Circular	Circular
3	M	16	5¼	5½	+	+	+	+	+	+					Circular	Circular
4	M	18	5	5½	+	+	+	+	+	+	−	−			Irregular	Slightly irregular.
5	F	19	4½	4½	+	+	+	+	−	−	−	−			Circular	Circular
6	F	22	4½	5	+	+	+	+	+	+	+	+			Circular	Circular
7	F	23	5½	5½	+	+	+	+	+	+	+	+			Circular	Circular
8	F	24	5	5	+	+	+	+	−	+	+	+			Circular	Circular
9	F	26	5	5	+	+	+	+	+	+	−	−			Circular	Circular
10	F	28	5½	5½	+	+	+	+	+	+	−	−			Circular	Circular
11	F	28	5	5	+	+			+	+					Circular	Circular
12	F	30	6	6	+	+	+	+	−	−	+	+			Slightly irregular	Slightly irregular.
13	F	31	5	5	+	+			+	+					Circular	Circular
14	F	31	5½	5½	+	+	+	+	−	−	0	0	−	−	Circular	Circular
15	F	37	6½	6	+	+			+	+	0	0			Circular	Circular
16	M	38	5¼	6	+	+	+	+	+	+	+	+	+	+	Circular	Slightly irregular.
17	M	39	5¼	4¾	+	+	+	+	+	+	−	−			Very irregular	Very irregular.
18	F	43	5	5	+	+	+	+	+	+	+	+			Circular	Circular
19	F	49	4	4	+	+	+	+	+	+	0	0			Circular	Circular

H

			Size of Pupils in MM.		Reaction to Light		Reaction to Light		Reaction to Near Vision		Reaction to Sensory Stimuli		Pupillary Unrest		Outline of Pupils	
					Direct		Consens.									
No.	Sex	Age	R	L	R	L	R	L	R	L	R	L	R	L	Right	Left
IX Higher-Grade Imbecility - page 65.																
1	M	19	5	5	+	+	+	+	+	+	+	+			Circular	Circular
2	M	20	4½	5	+	+	+	+	+	+	−	−			Circular	Circular
3	M	37	4½	4½	+	+	+	+	+	+	−	−			Irregular	Irregular
4	M	47	5	5	+	+	+	+	+	+	+	+			Circular	Slightly irregular.
X Imbecility - page 65.																
1	M	19	5¾	5¾	+	+	+	+	+	+	−	−			Elliptical	Circular
2	F	24	4¼	4¼	+	+	+	+	+	+	−	−			Circular	Circular
3	M	25	5	6	+	+	+	+	+	−	0	0			Circular	Circular
4	M	26	7	6½	+	+	+	+	+	+	−	−			Irregular: quadrilateral	Irregular: oval.
5	F	27	6½	6½	+	+	+	+	+	+	−	−	+	+	Circular	Circular
6	M	33	6½	6½	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular
7	F	34	4	4	+	+	−	−	−	−	−	−			Circular	Circular
8	F	40	6	6	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular
9	M	40	5½	4¾	−	−	−	−	+	+	−	0			Irreg.: pear-shaped.	Irreg.: pear-shaped.
10	M	41	5	5¼	+	+	+	+	+	+	−	−			Irregular	Irreg.: D-shaped.
XI Idiocy - page 66.																
1	F	18	6	6	+	+			+	+	+	+			Circular	Circular
2	F	28	5	5	+	+			+	+	+	+			Circular	Circular
3	F	28			+	+			+	+	+	+			Circular	Circular
4	F	30	7½	7½	+	+	+	+	+	+	−	−			Circular	Circular
5	F	37	6½	5½	+	+										
6	F	40	5	5¼	+	+			+	+	−	−			Slightly oval	Circular
7	F	41	6	6	+	+	+	+	+	+	−	−			Circular	Circular
8	F	45	4	4½	+	+			+	+	−	−			Circular	Circular
XII Hebephrenia - page 72.																
1	F	17	5¼	5	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular
2	M	22	7	7	+	+	+	+	+	+	+	+	+	+	Circular	Circular
			5¾	6	+	+	+	+			−	−	−	−	Corectopia, irregular.	Corectopia: slight irreg.
3	F	24	6	6	+	+	+	+	+	+	+	+			Circular	Circular
4	F	27	5	5	+	+			+	+					Circular	Circular
5	F	29	4½	4½	+	+	+	+	+	+	−	−			Circular	Circular
6	F	32	5	5	+	+			+	+					Circular	Circular
7	F	37	5	5	+	+	+	+	+	+	+	+			Circular	Circular
8	F	37	4	4	+	+	+	+	+	+	−	−			Circular	Circular
9	M	40	5½	5½	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular.
10	M	41	5	5½	+	+	+	+	+	+	0	0			Circular	Slightly elliptical.

Date.

14.2.13

7.3.13

I

J

	No.	Sex	Age	Size of Pupils in Mm. R	Size of Pupils in Mm. L	Reaction to Light Direct R	Reaction to Light Direct L	Reaction to Light Consens. R	Reaction to Light Consens. L	Reaction to Near Vision R	Reaction to Near Vision L	Reaction to Sensory Stimuli R	Reaction to Sensory Stimuli L	Pupillary Unrest R	Pupillary Unrest L	Outline of Pupils Right	Outline of Pupils Left	Date.
XIII Katatonia - page 12.	1	M	15	7½	7½	+	+	+	+	+	+	−	−	+	+	Circular	Circular	26.10.12
				5¼	5¼	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Circular	7. 3. 13
	2	M	19	7½	7½	+	+	+	+	+	+	+	+			Circular	Somewhat oval	4.10.12
				6½	6½	+	+	+	+	+	+					Circular	Circular	28. 1. 13
				6½	7	+	+	+	+	+	+	+	+	+	+	Corectopia: slight irreg.	Corectopia: slight irreg.	14. 2. 13
				6¼	6½	+	+	+	+	+	+	−	−	−	−	Circular	Slightly irregular	11. 3. 13
				5	6	−	−	−	−	+	+	0	0	0	0			13. 3. 13
				4¼	4	+	+	+	+			−	−	−	−			15. 3. 13
				R < L		+	+					−	−	−	−			16. 3. 13
	3	M	21	4¼	4¼	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular	
	4	F	22	4½	4½	+	+	+	+	+	+	0	0			Circular	Circular	
	5	M	22	6	5¾	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular	
	6	M	23	4¾	5	+	+	+	+	−	+	+	+			Slightly irregular	Slightly irregular	
	7	F	23	5½	5	+	+	+	+	+	+	−	−	−	−	Circular	Circular	
	8	M	23	5	5¼	+	+	+	+	+	+					Slightly irregular	Slightly irregular.	
	9	F	24	6	6	+	+	+	+	+	+	0	0			Circular	Circular	
	10	F	26	5½	5½	+	+	+	+	+	+	−	−			Circular	Circular	
	11	F	26			+	+			+	+					Circular	Circular	
	12	M	28	7½	7½	+	+	+	+	−	−	−	−			Oval	Oval	19.9.12
				7	7	+	+	+	+	+	+	−	−	+	+	Circular	Slightly irregular	7.2.13
	13	F	28	5	5	−	−	−	−	+	+	−	−	+	+	Slightly irregular	Slightly irregular	
	14	F	29	5	5	+	+	+	+	+	+	0	0			Slightly irregular	Slightly irregular	
	15	M	33	6	6	+	+	+	+	+	+	−	−	+	+	Slightly irregular	Circular	
	16	F	34	5½	5½	+	+			+	+	0	0			Circular	Circular	
	17	M	38	4	4¼	−	−	−	−	+	+	0	−	0	0	Irregular	Very irregular	12.2.13
				3¼	3¾	−	−	−	−	−	−	+	−	−	−	Slightly irregular	Slightly irregular	7. 3. 13.
XIV Paranoia with Dementia - page 14.	1	M	27	6	5½	+	+	+	+	+	+	+	+	+	+	Corectopia: circul:	Corectopia: circular	
	2	F	33	5	5	+	+	+	+	+	+	−	−			Circular	Circular	
	3	F	49	5	4½	+	+	+	+	+	+	−	−			Circular	Circular	
XV Paranoia - page 14.	1	F	48	5½	6	+	+	+	+	+	+	+	+	+	+	Slightly oval	Circular	
	2	F	56	R = L		+	+	+	+	+	+	−	−	−	−	Circular	Circular	
	3	M	58	4½	4¾	+	+	+	+	+	+	+	+	+	+	Circular	Slightly irregular.	
	4	M	61	4	3½	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular	
	5	M	74	3¼	3¼	+	+	+	+	+	+	−	−			Somewhat D-shaped.	Somewhat D-shaped.	

K

XVI

Melanchalia of Involution - page 75.

No.	Sex	Age	Size of Pupils in MM. R	L	Reaction to Light Direct R	L	Reaction to Light Consens. R	L	Reaction to Near Vision R	L	Reaction to Sensory Stimuli R	L	Pupillary Unrest R	L	Outline of Pupils Right	Left	Date.
1	F	42	5½	5	+	+	+	+	+	+	0	0			Slightly irregular	Slightly irregular	3.10.11
			5¾	5¼	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular	24.10.11
2	F	44	5½	5¼	+	+	+	+	+	+	−	−	+	+	Slightly irregular	Circular	
3	F	44	5½	5½	−	−	−	−	+	+	−	−	+	+	Corectopia: circul.	Corectopia: slight irreg.	31.10.11
			5¾	5¾	−	−	−	−	+	+	+	+	−	−	Slightly irregular	Slightly irregular	8.11.11
4	F	44	5½	5½	+	+	+	+	+	+	+	+	+	+	Corectopia: slight irreg.	Corectopia: slight irreg.	3.10.11
			5¾	5¼	+	+	+	+	+	+	+	+	+	+	Corectopia: irreg. oval.	Oval, slightly irreg.	24.10.11
5	F	45	4½	4½	−	+	−	+	−	+	+	+			Slightly irregular	Slightly irregular.	
6	F	47	4½	5	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular	
7	F	49	5¼	5½	+	+	+	+	+	+	+	+	+	+	Irregular	Irregular	9.11.10
			5	5½	+	+	+	+	+	+	+	+			Slightly elliptical.	Slightly oval.	23.11.10
		50	5½	5¾	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular	24.10.11
8	F	51	5¾	6	+	+	+	+	+	+	−	−	−	−	Circular	Slightly irregular	22.11.11
			5¼	5	+	+	+	+	+	+	−	−	+	+	Slightly irregular	Slightly irregular	28.11.11
9	F	53	4½	4	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular	3.10.11
			4¾	4	+	+	+	+	+	+					Slightly irregular	Slightly irregular	31.10.11
10	F	54	5½	5½	+	+	+	+	+	+	−	−			Circular	Slightly elliptical	
11	F	55	4	3¾	+	+	+	+	+	+	−	−			Circular	Slightly irregular	
12	F	57	4	4	+	+	+	+	+	+	−	−	+	+	Slightly irregular	Slightly irregular	
13	F	58	4½	4½	+	+	+	+	+	+	+	+	+	+	Circular	Circular	
14	F	60	4¾	5	−	−	−	−	+	+	−	−	−	−	Circular	Circular	
15	F	61	4¼	4½	+	+	+	+	+	+	+	+			Circular	Circular	
16	F	64	3¾	3¾	+	+	+	+	+	+	+	+			Circular	Circular	
17	M	43	4¾	4½	+	+	+	+	+	+	+	+			Circular	Circular	28.8.12
			4¾	4¾	+	+	+	+	+	+	0	0	0	0	Corectopia: circular	Corectopia: slight irreg.	13.2.13
18	M	47	6	5½	+	+	+	+	+	+					Circular	Somewhat oval	22.11.12
			4½	5½×5¼	+	+	+	+	+	+	−	−	+	+	Slightly irregular	Oval, irregular.	13.2.13.
19	M	48	4½	4¾	+	+	+	+	+	+	+	+	+	+	Circular	Corectopia: slight irreg.	
20	M	49	5	4½	+	+	+	+	+	+					Corectopia: circular	Slightly oval.	
21	M	53	3¾	3½	+	+	+	+	−	−	−	−			Irregular	Irregular	14.10.12
			4	3¾	−	−	−	−	+	+					Irregular	Irregular	5.2.13
22	M	56	5½	5¼	+	+	+	+	+	+	+	+			Circular	Circular	
23	M	56	5¼	6	+	+	+	+	+	+	−	+	+	+	Irregular	Circular	
24	M	59	4½	4¾	+	+	+	+	+	+					Circular	Circular	
25	M	61	4¾	5½×5	0	0	0	0	+	+					Slightly irregular	Irregular, elliptical.	18.1.13
			4¼	4¾	0	0	0	0	+	−	−	0	−	−	Slightly irregular	Irregular	7.2.13
26	M	64	4½	4¾	−	−	−	−	+	+	+	+	+	+	Irregular	Irregular	
27	M	65	4¾	4¾	−	−	−	−	+	+	−	−	0	0	Slightly irregular	Slightly irregular.	

K

L

	No.	Sex	Age	Size of Pupils in Mm. R	Size of Pupils in Mm. L	Reaction to Light Direct R	Reaction to Light Direct L	Reaction to Light Consens. R	Reaction to Light Consens. L	Reaction to Near Vision R	Reaction to Near Vision L	Reaction to Sensory Stimuli R	Reaction to Sensory Stimuli L	Pupillary Unrest R	Pupillary Unrest L	Outline of Pupils Right	Outline of Pupils Left	Date.
XVII	1	M	65	4¼	4¼	−	−	−	−	+	+					Slightly irregular	Slightly irregular	
	2	M	65	3¼	3¾	−	−	−	−	+	+	+	+	−	−	Slightly irregular	Slightly irregular	
	3	M	65	4½	6	+	−	0	−	+	−	+	+			Oval	Irregular (amaurosis)	13.12.11
				4½	4½	+	0	0	+	+	+	−	−	−	−	Slightly irregular	Slightly irregular	25.12.11
	4	M	67	4	4½	−	0	−	0			0	0			Irregular, flattened	Irregular	
	5	M	67	3¾	3½	−	−	−	−	−	−	0	0			Irregular	Irregular	
	6	M	67	4½	5	+	+	+	+	+	+	+	+			Irregular	Circular	
	7	F	68	2½	2½	−	−	−	−	+	+	+	+			Circular	Circular	
	8	M	69	4½	4	+	+	+	+	+	+					Slightly irregular	Slightly irregular.	
	9	M	69	4	4	−	−	−	−	−	−	−	−			Slightly irregular	Slightly irregular.	
	10	M	70	4¾	5	+	+	+	+	+	+					Slightly irregular	Slightly irregular	
	11	F	71	5	5	−	−	−	−	−	−	0	0	0	0	Irregular	Irregular	
	12	M	72	3¾	4½	−	−	−	−	−	−					Irregular	Irregular	
	13	M	73	3¾	4	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular.	
	14	M	74	6½	6½	+	+	+	+	+	+	−	−			Slightly irregular	Circular	
	15	M	75	4	3¾	+	+	+	+	+	+	−	−			Circular	Circular	
	16	M	77	2½	3	−	−	−	−	−	−					Irregular	Irregular.	
XVIII	1	F	23	5½	5½	+	+	+	+	+	+	+	+	+	+	Circular	Circular	31.10.11
				6	6	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular	8.11.11
				5½	5½	+	+	+	+	+	+	−	−	+	+	Circular	Circular	22.11.11
	2	F	26	6	6	+	+	+	+	+	−	+	+	+	+	Slightly irregular	Slightly irregular	
	3	F	26	5½	5¾	+	+	+	+	+	+	+	+	−	−	Slightly oval.	Slight corectopia-oval	
	4	F	27	5	4½	+	+	+	+	+	+	+	+			Somewhat oval	Somewhat oval.	
	5	F	27	5	5	+	+	+	+	+	+	+	+			Circular	Circular	
	6	F	32	6	5¾	+	+	+	+	+	+	+	+	+	+	Slightly irregular.	Slightly irregular.	
	7	M	33	5¾	5¾	+	+	+	+	+	+	0	0			Irregular	Circular	5.2.13
				5¾	5¾	+	+	+	+	+	+	0	0	+	+	Irregular, flattened.	Irregular.	14.2.13
	8	F	33	5½	5½	+	+	+	+	+	+	+	+	+	+	Circular	Circular	8.11.12
				5½	5½	+	+	+	+	+	+	−	−	−	−	Oval, slightly irreg.	Slightly irregular.	22.11.12
	9	F	34	6	6	+	+	+	+	+	+	−	−	+	+	Slightly irregular	Circular	
	10	F	34	5¾	5½	+	+	+	+	+	+	+	+	−	−	Irregular	Irregular	7.11.11
				5¼	5¼	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular	22.11.11
	11	F	34	4½	4½	+	+	+	+	+	+	−	−	+	+	Circular	Circular	
	12	M	37	4¼	4¼	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular	
	13	M	39	5	5	+	−	+	−	+	+	+	+	+	+	Slightly irregular	Irregular	
	14	M	43	6½	6½	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular.	

Senile Dementia - Page 78.

Melancholia (First Attack) - Page 80.

M

	No.	Sex	Age	Size of Pupils in Mm. R	Size of Pupils in Mm. L	Reaction to Light Direct R	Reaction to Light Direct L	Reaction to Light Consens. R	Reaction to Light Consens. L	Reaction to Near Vision R	Reaction to Near Vision L	Reaction to Sensory Stimuli R	Reaction to Sensory Stimuli L	Pupillary Unrest R	Pupillary Unrest L	Outline of Pupils Right	Outline of Pupils Left	Date.
XIX	1	F	32	5½	5½	+	+	+	+	+	+	+	+	+	+	Circular	Circular	
	2	F	42	5¾	5½	+	+	+	+	+	+	+	+	+	+	Slightly oval	Slightly oval	
	3	F	39	5¾	5½	+	+	+	+	+	+	−	−	+	+	Circular	Circular	17.10.11
				5½	5	+	+	+	+	+	+	+	+			Circular	Circular	24.10.11
	4	M	55	5½	5¼	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular.	
XX	1	M	23	5	5½	+	+	+	+	+	+	+	+	+	+	Circular	Circular	
	2	M	26	4½	-	+				+		+		+		Irregular	(Eye enucleated)	
	3	M	27	5	6¼	+	+	+	+	+	+	+	−			Circular	Slightly irregular. (amblyopic eye)	
	4	M	28	5¾	5½	+	+	+	+	+	+	−	−	+	+	Circular	Circular.	
	5	F	35	5¾	5¾	+	+	+	+	+	+	−	−	−	−	Circular	Circular	
	6	F	36	5	5¼	+	+	+	+	+	+	−	−	−	−	Circular	Circular	
	7	M	40	7	6½	+	+	+	+	+	+					Circular	Circular	
	8	F	47	4½	4¾	+	+	+	+	+	+	+	+	+	+	Slightly irregular.	Slight irreg. & corectopia	
	9	M	50	5½	5¼	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular.	
	10	M	52	4	4	−	−	−	−	−	−	−	−			Slightly irregular	Slightly irregular	7.1.12
			53	4¾	4½	−	−	−	−	+	+	0	0			Irregular	Irregular	7.11.12
	11	F	53	4¾	5	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular.	
	12	F	59	5½	5¾	+	+	+	+	+	+	+	+			Circular	Circular	
	13	F	63	5½	5	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular.	
XXI	1	F	20	6½	7	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular	9.11.10
				7	7½	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular	23.11.10
	2	M	20	6¾	6½	+	+	+	+	+	+	+	+			Circular	Circular	
	3	F	22	5½	5½	+	+	+	+	+	+	+	+			Approx. circular	Corectopia	17.11.11
				5½	5½	+	+	+	+	+	+	+	+	−	−	Slightly irregular	Slightly irregular.	28.11.11
	4	F	26	5½	5½	+	+	+	+	+	+	+	+	+	+	Circular	Circular	3.10.11
				6	6	+	+			+	+	+	+			Slightly oval	Slightly oval	24.10.11
				5½	5¼	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular	31.10.11
	5	M	27	7	7	+	+	+	+	+	+	−	−	+	+	Circular	Circular	25.6.12
			28	6½	6½	+	+	+	+	+	−	−	−	+	+	Slightly irregular	Circular	18.2.13
	6	M	27	5¼	4¾	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular	
	7	M	27	6¼	6¼	+	+	+	+	+	+	+	+			Circular	Circular	
	8	F	28	5½	6	+	+	+	+	+	+	−	−	+	+	Irregular	Irregular	17.10.11
				5½	5½	+	+	+	+	+	+	+	+	+	+	Circular	Circular	28.11.11
	9	M	28	5½	6	+	+	+	+					+	+	Slightly irregular	Slightly irregular	
	10	M	29	4½	5	+	+	+	+	+	+	−	−	+	+	Circular	Circular	
	11	M	31	4¾	4¾	+	+	+	+	+	+					Slightly irregular	Irregular.	

Melancholia (Recurrent) - page 80.

Mania (Recurrent) - page 80.

Mania (First Attack) - page 80.

M

N

Date.

	No.	Sex	Age	Size of Pupils in Mm. R	L	Reaction to Light Direct R	L	Reaction to Light Consens. R	L	Reaction to Near Vision R	L	Reaction to Sensory Stimuli R	L	Pupillary Unrest R	L	Outline of Pupils Right	Left
XXI continued - Mania (First Attack)	12	F	31	4¼	4½	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular
	13	F	31	5½	5½	+	+	+	+	+	+	+	+	−	−	Slightly irregular	Slightly irregular.
	14	M	32	6	5½	+	+	+	+	+	+	0	0			Slightly irregular	Slightly irregular.
	15	F	35	6	6	+	+	−	+	+	+			0	0	Circular	Circular
	16	F	35	5½	5½	−	+	+	+	−	+	+	+			Irregular, elliptical	Irregular, elliptical
	17	M	36	4½	4½	+	+	+	+	+	+	+	+			Circular	Circular
XXII Chronic Mania - page 82.	1	F	30	6	6	+	+	+	+	+	+	+	+	−	−	Circular	Circular
	2	F	31	5	5	+	+	+	+	+	+	+	+			Circular	Circular
	3	F	33	R=L		−	−	−	−	−	−					Circular	Circular
	4	F	34	4	4	+	+	+	+	+	+	+	+			Circular	Circular
	5	F	35	5½	5½	+	+	+	+	+	+	+	+			Circular	Circular
	6	F	36	5	5	+	+									Circular	Circular
	7	M	37	5¼	5½	+	+	+	+	+	+	−	−	+	+	Circular	Slightly irregular
	8	F	39	4½	4½	+	+	+	+	+	+	−	−			Circular	Circular
	9	F	40	4	4	+	+	+	+	−	−	+	+			Elliptical	Elliptical
	10	F	41	R=L		+	+			+	+	+	+			Circular	Circular
	11	F	42	5½	5¼	+	+	+	+	+	+	0	0			Circular	Circular
	12	F	44	3	3	+	+			+	+	+	+			Circular	Circular
	13	F	44	4¼	4¼	+	+	+	+	+	+	+	+			Circular	Circular
	14	F	44	5¼	5	+	+	+	+	+	+	−	−			Circular	Circular
	15	F	44	5½	5¼	+	+	+	+	+	+	+	+			Circular	Circular
	16	F	46	5	5	+	+			+	+					Circular	Circular
	17	F	49	R=L		+	+			+	+					Circular	Circular
	18	F	50	5¼	5¼	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular
	19	F	50	5½	5½	+	+	+	+	+	+	−	−			Circular	Circular
	20	F	54	4	4	+	+			+	+	+	+			Circular	Circular
	21	F	55	4½	4½	+	+	+	+	+	+	+	+			Circular	Circular
	22	F	60	4¾	4¾	+	+	+	+	+	+	−	−			Oval: slight corectopia	Oval.
XXIII Terminal Dementia - page 82.	1	F	40	6	6	+	+	+	+	+	+	−	−			Slightly irregular	Slightly irregular
	2	F	44	4¾	4½	+	+			+	+	−	−			Circular	Circular
	3	F	44			+	+			+	+					Circular	Circular
	4	F	46	5½	5½	+	+	+	+	+	+	+	+			Slightly oval	Circular
	5	F	52			+	+									Circular	Circular
	6	F	57	4	4	+	+			+	+					Circular	Circular
	7	F	60	4½	4½	+	+	+	+	+	+	+	+			Circular	Circular
	8	F	63	3	3¼	+	+									Circular	Circular

N

O

XXIII Continued - Terminal Dementia

Date.

No.	Sex	Age	Size of Pupils in Mm. R	Size of Pupils in Mm. L	Reaction to Light Direct R	Reaction to Light Direct L	Reaction to Light Consens. R	Reaction to Light Consens. L	Reaction to Near Vision R	Reaction to Near Vision L	Reaction to Sensory Stimuli R	Reaction to Sensory Stimuli L	Pupillary Unrest R	Pupillary Unrest L	Outline of Pupils Right	Outline of Pupils Left
9	F	64	R=L		+	+	+	+	+	+	−	−	—	—	Circular	Circular
10	F	70	5¼	5½	+	+	+	+	+	+	+	+			Circular	Circular
11	F	72	4½	4½	+	+	+	+	+	+	+	+			Circular	Circular
12	F	73	4¼	4	+	+	+	+	+	+	+	+			Slightly irregular	Slightly irregular
13	F	74	4	4	+	−	−	+	+	+	+	+			Slightly irregular	Slightly irregular (Cataract)
14	F	74	3½	3¼	+	+			+	+					Slightly irregular	Circular.

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